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REVISION OF THE GENUS *MELITTOBIA* (CHALCIDOIDEA : EULOPHIDAE) WITH THE DESCRIPTION OF SEVEN NEW SPECIES.

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ABSTRACT

This taxonomic revision of the genus *Melittobia* contains 2 new combinations, *Tachinobia diopsisephila* (Risbec), *Cirrospilus* (*Atoposomoidea*) *cosmopterygi* (Risbec); a generic diagnosis; the redescription of 7 species, *clavicornis* (Cameron), *acasta* (Walker), *chalybii* Ashmead, *megachilis* (Packard), *hawaiiensis* Perkins, *australica* Girault and *bekiliensis* Risbec; description of 7 new species, *evansi, scapata, femorata, assemi, sosui* and one from Argentina not named because of lack of suitable specimens for type selection; synonymies, *strandi* Wolff and Krausse and *Anthophorabia fasciata* Newport become *acasta* (Walker), *japonica* Masi becomes *clavicornis* (Cameron), *sceliphronidis* (Brèthes) becomes *hawaiiensis* Perkins, *Tachinobia gradwelli* Bouček becomes *T. diopsisephila* (Risbec); *osmiae* Thompson and *hawaiiensis peles* Perkins remain unidentifiable in the absence of types and definitive descriptions; figures and keys are provided to aid in identification of species.

MATERIALS AND METHODS

Specimen Mounting

The methods for mounting *Melittobia* are standards used for other Chalcidoidea involving air dried specimens glued to a card rectangle or cleared in 10% NaOH for mounting on a microscope slide.

Air drying specimens after mounting on a card results in totally collapsed specimens and alteration of subtle colour differences. Added to this is the problem of leaching in ethyl alcohol, e.g. after 12 months in 75% ethyl alcohol some specimens become off-white. Gordh and Hall (1979) reported excellent results using a critical point dryer for specimen preparation of Chalcidoidea before mounting. The procedure involves collecting specimens into 75% ethyl alcohol, slowly dehydrating with alcohol, substitution of liquid CO_2 for absolute alcohol under pressure, raising the temperature until the liquid CO_2 dissolves to gas and finally bleeding off the CO_2 gas. The result with *Melittobia* was beautifully inflated specimens with natural colours which then were mounted on card rectangles. Unfortunately, I have only had access to a critical point dryer for 12 months, therefore most of the specimens at my disposal for this revision were air dried and others were slightly leached because of storage in alcohol. Fortunately some are in very good condition. Notes on specimen preservation are given with the colour notes on each species.

Microscope slide preparations were made for each species depending upon availability of specimens, e.g. in the case of *M. diopsisephia* only 2 ♀♀, 1 ♂ exist and no slides were prepared. Wings were first removed from the specimens and placed in Euparal on a microscope slide. The head and body were soaked in 10% NaOH until clear then taken in 15 minute steps through 15% acetic acid, distilled water after which they were dehydrated in ethyl alcohol. When dehydrated they were transferred to a 1:1 mixture of absolute alcohol and Terpineol and placed under an incandescent bulb until the ethyl alcohol had evaporated. Antennae, heads and bodies were separated and mounted in Euparal. This procedure is discussed more fully by Prinsloo (1980).

Figures

All figures except 1–3 were drawn from cleared, microscope slide-mounted speicmens and each has the scale indicated. They were drawn with a camera lucida fitted to a Wild M20 compound microscope and constant magnifications were used for the same part or appendage of all species. Figures 1–3 were drawn from freshly killed, dry-mounted specimens with a camera lucida fitted to a Leitz TS stereomicroscope.

TERMINOLOGY

The terminology used follows that of de V. Graham (1969) except that the body is divided into head, mesosoma (thorax and propodeum) and metasoma (remainder of the abdomen). Figures 1–13 serve to illustrate the general

morphology of *Melittobia* species and the terminology used.

HISTORICAL RESUME

The genus *Melittobia* belongs to the chalcidoid family Eulophidae, sub-family Tetrastichinae. Ferrière (1960) grouped it with five other genera of tetrastichine eulophids on the basis of their common possession of a dorsoventrally flattened thorax and large pronotum (*Crataeopoides* Zinna, 1955; *Crataepus* Förster, 1878; *Aceratoneuromyia* Girault, 1917; *Pronotalia* Gradwell, 1957; *Crataepiella* Domenichini, 1956). Peck, Bouček and Hoffer (1964) sank two of these — considering *Crataepoides* a junior synonym of *Elachertus* Spinola, 1811 and *Pronotalia* a junior synonym of *Crataepiella.*

Domenichini (1966) divided the Tetrastichinae into two tribes; the Tetrastichini with a genal sulcus and Melittobiini without a genal sulcus. The latter comprised *Melittobia, Aceratoneuromyia, Crataepus* and *Crataepiella* — the four genera from Ferrière's grouping above. In the same year, Bouček described *Kocourekia* and placed it with genera lacking a genal sulcus. Bouček (1977) described the genus *Tachinobia* and although he made no reference concerning its tribal placement it clearly fits with these genera as the description mentions the lack of a genal sulcus.

None of these treatments take into account many of Girault's genera except *Aceratoneuromyia.* Of the large number of genera described by Girault from Australia, it is not known if any more could be placed in the group lacking a genal sulcus. A revision of Girault's eulophid genera is presently being undertaken by Dr. Bouček. Clarification of this point therefore rests with him.

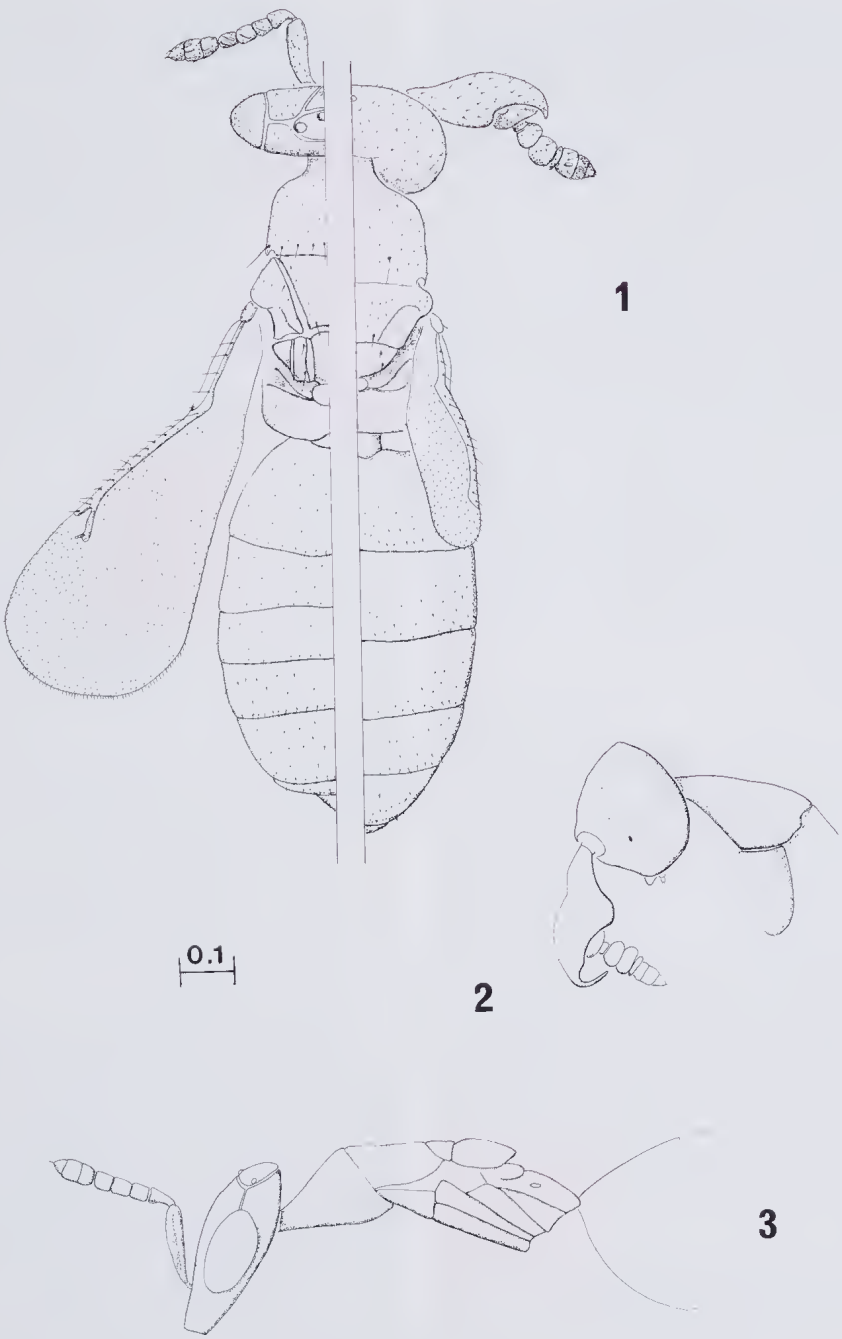
In summary then, we have six tetrastichine genera, *Aceratoneuromyia, Crataepus, Crataepiella, Kocourekia, Melittobia* and *Tachinobia,* grouped on the absence of a genal sulcus. *Crataepus* separates out easily because of the possession of a longitudinal median groove on the mesoscutum and two fore tibial spurs. The six genera show variation in the presence or absence of facial and ocellar lines, and delimitation of the vertex (a groove between the posterior ocelli and the eyes). Facial lines converging from the vertex or ocellar area to the scrobes occur in all except *Kocourekia.* The ocellar area is delimited into an ocellar plate by a groove in *Melittobia* and *Crataepiella.* All genera except *Aceratoneuromyia* have a delimited vertex. Bouček (1977) in his description of *Tachinobia* does not mention whether it has a delimited vertex, but his figure of the dorsal aspect of the female's head shows it to be not delimited. In ethyl alcohol preserved specimens of *T. repanda,* the type-species, the vertex is clearly delimited. In facial, ocellar and vertex grooves therefore *Melittobia* most closely resembles *Crataepiella.* The genera also vary in the number of grooves on the scutellum. In *Tachinobia* there are no grooves; *Kocourekia* and *Aceratoneuromyia* have 2 sub-lateral grooves; *Melittobia, Crataepus* and *Crataepiella* have 2 sub-lateral and 2 sub-median grooves.

Except for *Kocourekia* all of the genera are known from both sexes. Of these *Melittobia* and *Tachinobia* show pronounced sexual dimorphism with the males greatly modified. Male *Melittobia* are brachypterous with eyes reduced to a single spot whereas male *Tachinobia* are apterous with eyes reduced to several facets. In both, the antennal scapes of the male are greatly enlarged. *Tachinobia* males have a strongly inflated scape with a large clear area ventrally (Fig. 15). The scape of male *Melittobia* is also swollen but with a ventral groove, a cup-shaped depression or hardly grooved at all with a large ventral clear area (Figs 16–19). In the remaining genera, where males are known, they closely resemble the females, are macropterous and have scapes only slightly modified, if at all.

There are other features which separate the genera, e.g., the number of teeth on the mandibles, the degree of flattening of the prothorax, setation and so on. Bouček (1977) gave a tentative key to the Tetrastichinae which separates all six genera very well.

This taxonomic revision arose out of the necessity to establish the identity of a species of *Melittobia* whose biology and behaviour was under study Dahms (1983a). Comparison of my specimens with the type of the single Australian species, *M. australica* Girault, 1912, showed that they were conspecific. However, establishing the validity of Girault's species proved much more difficult as the following account from the literature reveals.

The generic name *Melittobia* Westwood (1847) arose in an atmosphere of confusion because of an argument between Mr G. Newport and Mr. J.O. Westwood over the authorship of this new genus. In 1849 the argument surfaced in the form of a series of letters from the two antagonists to the editors of the *Annals and Magazine of Natural History* published in that journal. The first letter was written by Newport in which he claimed to have been studying the insect since



FIGURES 1–3, *Melittobia australica*. 1 — Dorsal view female and male; 2 — side view male head; 3 — side view female head and mesosoma.

1832 and implied plagiarism by Westwood. However, Newport did not publish a description of the species until 1849 when he called the genus *Anthophorabia* and the species *retusa* after the host *Anthophora retusa* Le Peletier and Serville. His description was preceded by Westwood (1847) in his 'Introduciton to the Classification of Insects' where he mentioned the same species from specimens forwarded to him by Mr Audouin from the nests of *Odynerus, Anthophora* and *Osmia.* Westwood also exhibited these specimens in 1847 to the Entomological Society of London and a brief descriptive note appeared with the name *Melittobia audouinii* in that Society's Proceedings for 1847. He later published a more formal description in the *Proceedings of the Linnean Society* in 1849.

Of the two generic names *Melittobia* stands, but neither specific name stands because both had been preceded by Walker who described the species as *acasta* in 1839 and incorrectly assigned it to the genus *Cirrospilus* basing his description on a male that was in fact a female. From all of this, the genus is *Melittobia* Westwood 1847 and the type-species *Cirrospilus acasta* Walker 1939 by synonymy.

Although this confusion was removed fairly early (Smith (1853); Dalla Torre (1898)) further confusion has arisen at the species level. This appears to be related to the relative uniformity of the females. Ferrière (1933) thought it probable that several of the described species were synonyms of *M. acasta* or *M. hawaiiensis.* Examination of females of the various species shows they are difficult to separate and leads one to agree with Ferrière. However, if the greatly modified males are examined, it is clear there are more than two species. Males do not emerge from the host cell or puparium, therefore females are more commonly encountered and their apparent uniformity has led to many misidentifications, not only in collections, but also in the literature, e.g., the name *M. chalybii* Ashmead has been applied to at least 2 species of *Melittobia* from North America, neither of which is the true *M. chalybii.*

Perusal of the literature revealed 13 described species at the start of this revision. In addition there are *M. peloepi* Ashmead, 1892 (published without a description which means it is a nomen nudum) and *M. hawaiiensis peles* Perkins, 1907. Of the 13 species, 9 are known from both sexes and the remainder from females only. The initial goal was to build up a collection of species based on associated sexes and to use the males to separate species. Decisions were checked against notes on courtship behaviour generously provided by Dr van den Assem from his own work on this aspect of the genus. When the males were suitably sorted, females were checked for reliable morphological differences.

As a result of this study I am recognising 7 of the previously described species *M. clavicornis* (Cameron), *M. acasta* (Walker), *M. chalybii* Ashmead, *M. megachilis* (Packard), *M. australica* Girault, *M. hawaiiensis* Perkins and *M. bekiliensis* Risbec. Two of the three species described by Risbec were incorrectly placed by him in the genus *Melittobia. M. cosmopterygi* I have transferred to *Cirrospilus* Westwood and *M. diopsisephila* to *Tachinobia* Bouček. Four new synonymies occur; *M. japonica* Masi becomes *M. clavicornis* (Cameron), *M. sceliphronidis* (Brèthes) becomes *M. hawaiiensis, M. strandi* Wolff and Krausse and *M. fasciata* (Newport) become *M. acasta* (Walker). This leaves *M. osmiae* Thompson and *M. hawaiiensis peles* Perkins neither of which can be placed in the absence of diagnostic descriptions, and I have not been able to locate type-material.

Seven new species are described: *M. scapata, M. evansi, M. femorata, M. digitata* (from North America); *M. assemi* (Seychelles); *M. sosui* (Japan); and a new species from Argentina for which no types can be selected because the specimens are fragmentary.

As a result of ethological work, van den Assem (pers. comms., 1974–81) and van den Assem and Maeta (1978, 1980) divide the genus into species groups: *acasta* group, *hawaiiensis* group and Mahé *(assemi)* group. They regard *M. clavicornis* as the most primitive and keep it separated from these groups. Using morphological grounds the species separate easily on males into the same groups and this is discussed more fully later. For the purposes of the following discussions the species groupings are as follows:

ACASTA GROUP	*HAWAIIENSIS* GROUP	*ASSEMI* GROUP
acasta	*hawaiiensis*	*assemi* sp. nov.
evansi sp. nov.	*australica*	*sosui* sp. nov.
scapata sp. nov.	Kauai	*bekiliensis*
digitata sp. nov.		SP. NOV. Argentina
femorata sp. nov.		
megachilis		
chalybii		

INTRODUCTORY MORPHOLOGY

Sexual dimorphism in the genus is so extreme that the sexes cannot be associated by morphology alone (Fig. 1). Males are greatly modified and the modifications, involving appendages and body regions, can be related to the restriction of male activity to reproduction, i.e. fighting, courting and mating.

Females are a fairly typical tetrastichine eulophid form with fully developed wings and eyes except in the case of second-form females (see under Polymorphism Dahms, 1983a). They show no gross modifications for courtship and their most marked features are probably related to host seeking in confined spaces and excavation into or out of host enveloping membranes, e.g., enlarged prothorax and dorsoventral flattening of the body. In addition, the head is anteroposteriorally flattened and it articulates with the prothorax close to the vertex which allows the head to fold back almost in the same plane as the body (Fig. 3). The antennae are inserted low on the head and can be pushed forwards when the head is in the flattened position.

Males show a greater range of easily discernible, reliable, morphological features for separation of most species. They are brachypterous, lack compound eyes and are less pigmented than females (Fig. 5). These reductions are related to their not emerging from the host cocoon or puparium. Modifications have taken place to heads, antennae and legs, and these are related to the function of these parts in courtship and fighting. Variations in these modifications are related to specific variations in courtship repertoires.

At the generic level, the male scape is expanded, with a ventral groove or cup and is open distally (Figs 16–19). The groove or cup is used to house the female's antenna during courtship. Covering the distal opening of the scape is a flap-like pedicel which is used in manipulations of the female's antenna. The funicle is four-segmented with specific variation in the relative proportions of the segments (Figs 12, 187, 190, 193, 196, 199, 202, 205, 208, 213, 216, 219). Females have a funicle composed of three relatively uniform segments (Fig. 9).

In frontal aspect (Figs 5, 151–160) the male head is shorter than that of the female (Figs 38–48); the eyes are reduced to single spots, and the ocelli, although present, may be faint. In lateral aspect (Fig. 2) the head is greatly inflated in comparision to that of the female. This can be related to the need for large muscles to carry out the complicated courtship movements of the enlarged scape and for effective use in combat of the relatively larger mandibles. The prothorax remains large but the remainder of the mesosoma is reduced in correlation with the reduced wings and inability to fly.

Legs play an important part in courtship behaviour. The fore tarsi are used to hold the female by the neck. Fusion of tarsal segments 3 and 4 on the fore leg has occurred in most species, but there is fusion of 2, 3 and 4 in one group and fusion of all segments in another (Figs 20–22). There is a curving of the fused parts of segments 3 and 4 to accommodate the neck of the female. Mid legs are used by all species during all or part of the proceedings and the posterior, ventral surface of the mid femur in all species bears a very long fringe of setae. In some species a long fringe of setae also occurs on the mid trochanter ventrally. These setae appear to be used to brush the female's body during courtship. Their pattern and distribution varies between species (Figs 220–230).

The genitalia of males show very little variation except in size and are of little use taxonomically.

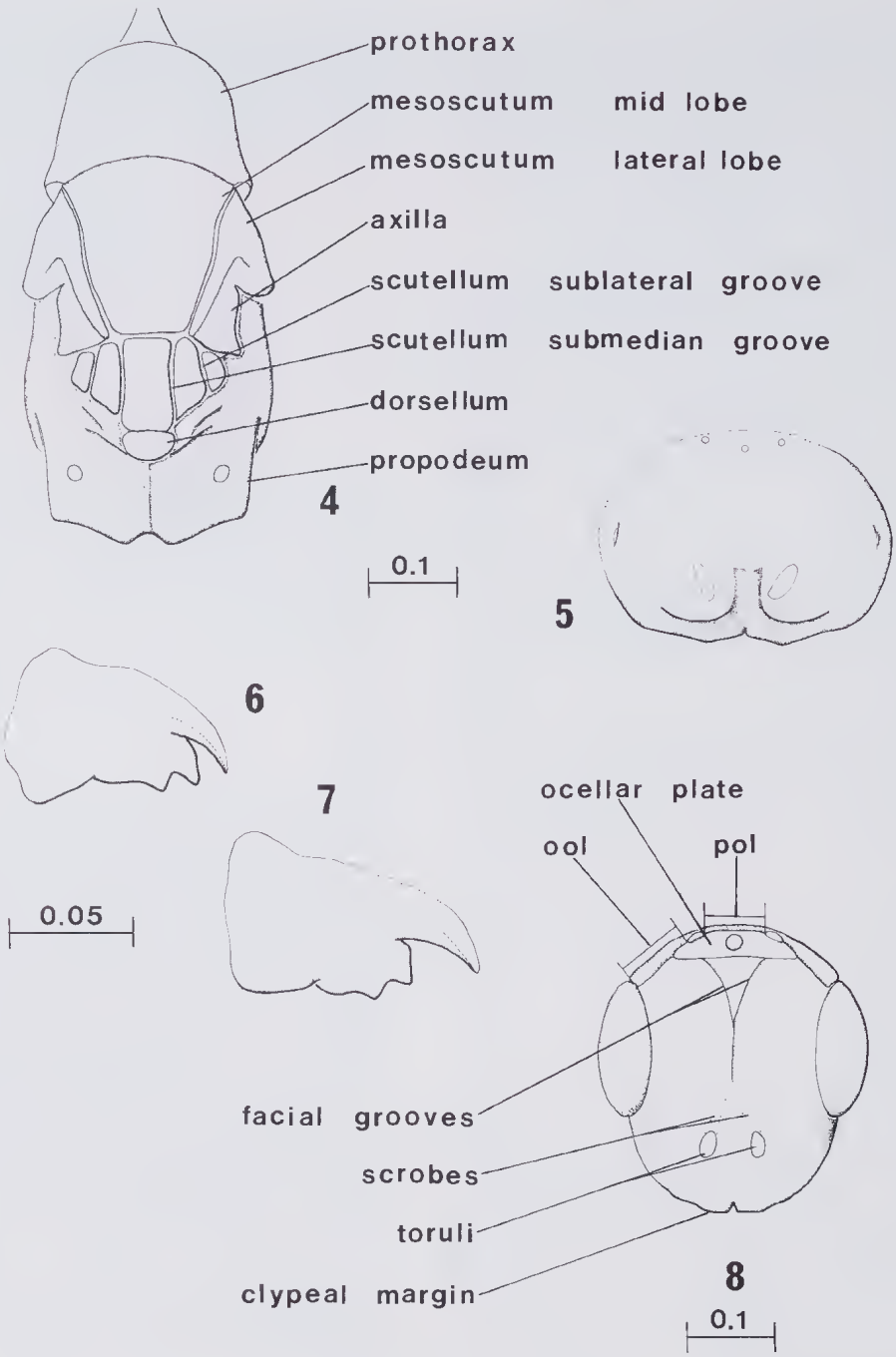
REVISION

Introductory Remarks

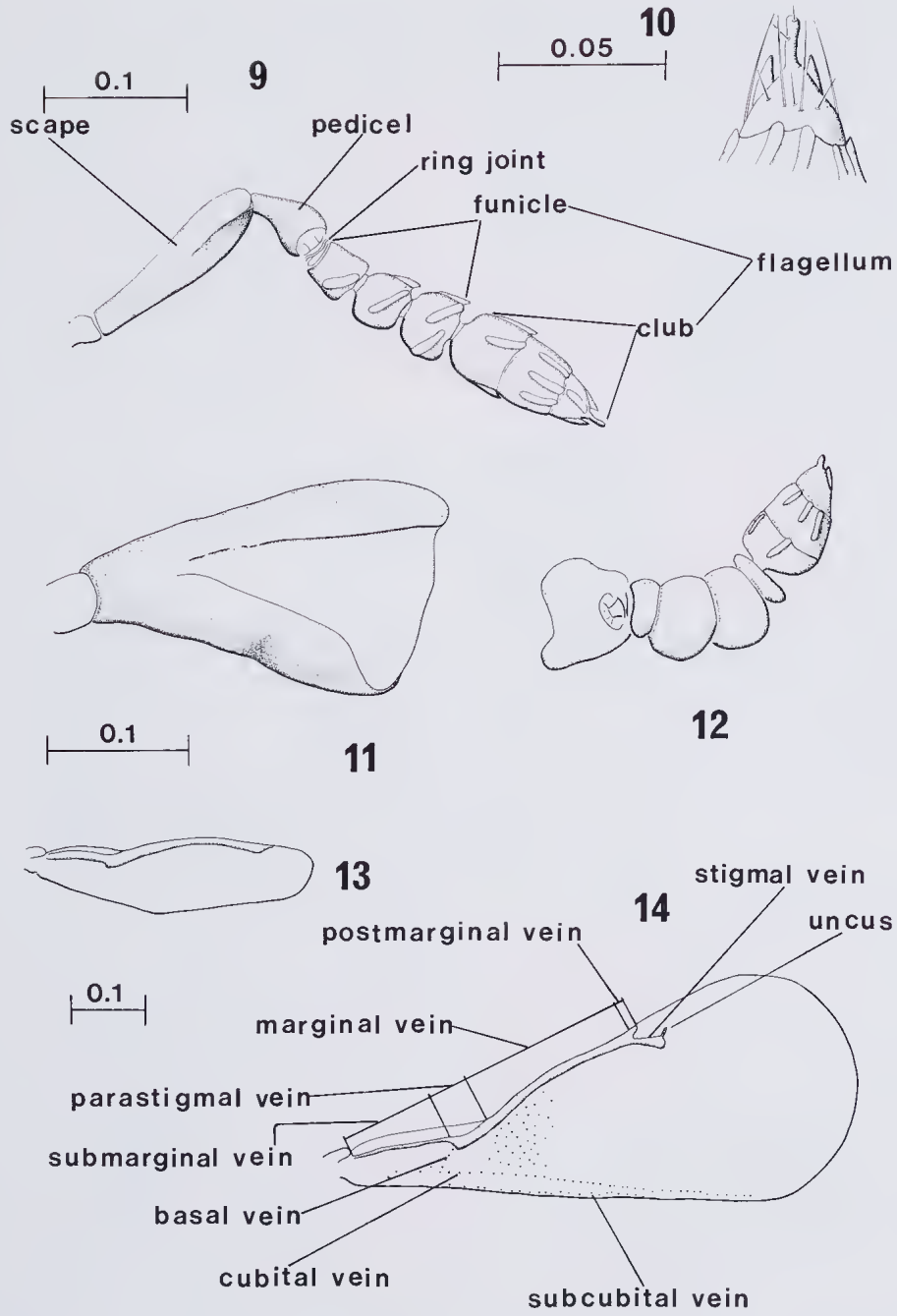
One of the major difficulties in dealing taxonomically with the genus was the apparent uniformity of females. This is mostly due to the gross distortion of the body of females on drying so that differences in the relative proportions of head and mesosoma could not be appreciated. Added to this has been the use by authors of unreliable characters e.g. many aspects of setation. This is again complicated by the description of a few species from the female sex only e.g. *M. megachilis* and *M. japonica*.

As discussed under Introductory Morphology, males show a great range of morphological features for separation of species and by obtaining sexes bred out together it has been possible to separate females of the different species. Distortion of females on drying was overcome by using a critical point dryer (Gordh and Hall, 1979), and several useful proportional features were revealed. In addition colours were preserved without fading, provided the specimens have not been kept for too long in ethyl alcohol. Preparation of microscope slides has allowed appreciation of differences in clypeal margins, antennae, palps, mandibles and wing venation in both sexes.

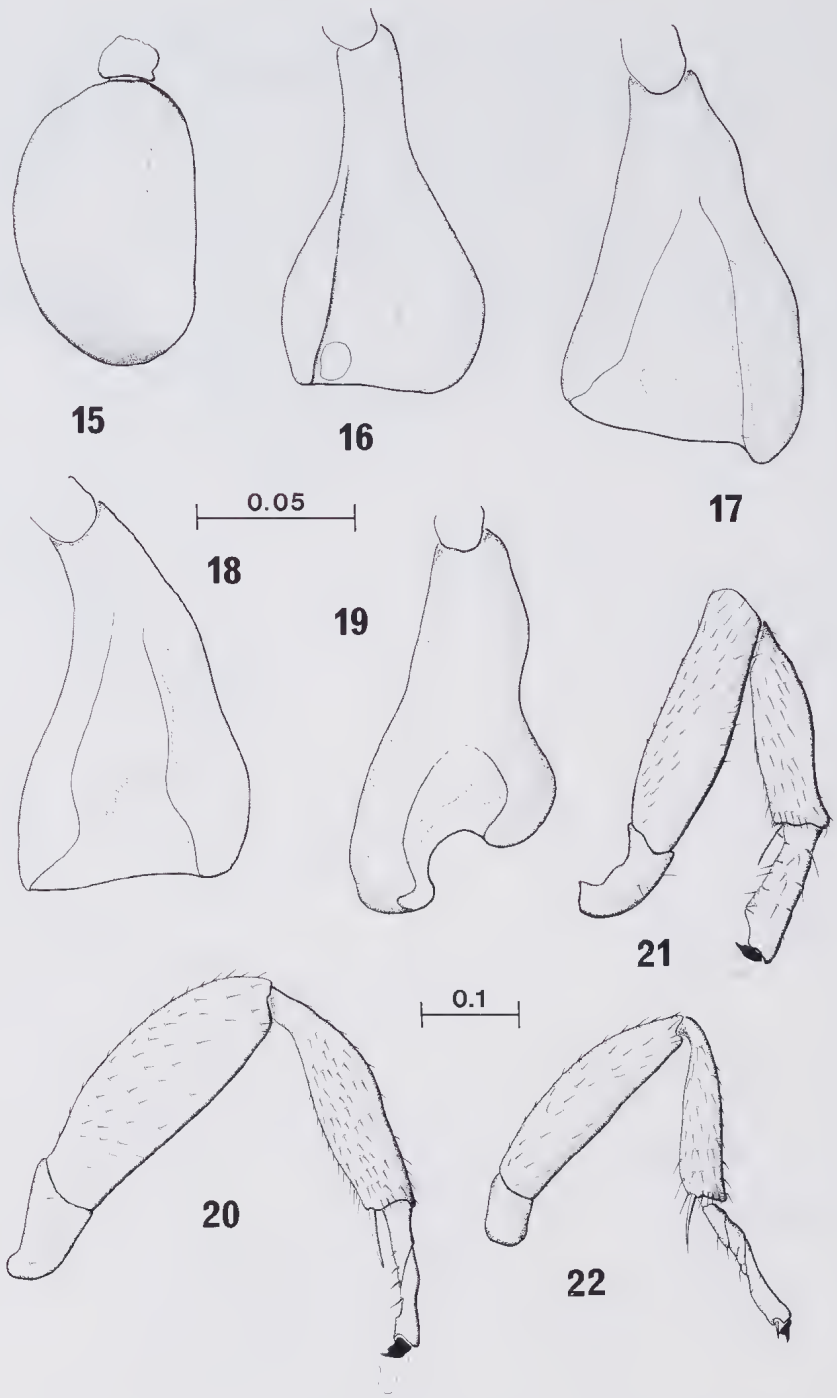
In spite of these techniques, difficulties still exist. Colours vary with the method of



FIGURES 4–8, *Melittobia australica*. 4 — Dorsal female mesosoma; 5 — Frontal aspect, male head; 6 — Female mandible; 7 — Male mandible; 8 — Frontal aspect, female head; POL = posterior ocellar line, OOL = ocellar — ocular line.



FIGURES 9–14, *Melittobia australica*. 9 — Female antenna; 10 — Club segment 3, female antenna; 11 — Male scape; 12 — male pedicel plus flagellum; 13 — Male wing; 14 — Female fore wing.



FIGURES 15–19, Male antennal scapes. 15 — *Tachinobia reparida;* 16 — *Melittobia clavicornis;* 17 — *Melittobia australica;* 18 — *Melittobia assemi* (sp. nov.); 19 — *Melittobia acasta.*

FIGURES 20–22, Male fore legs, *Melittobia* spp. 20 — *assemi* (sp. nov.); 21 — sp. nov. Argentina; 22 — *australica.*

preservation, for example, in older air-dried specimens males tend to become a fairly uniform brown whereas in fresh material subtle infuscations and colour differences occur. Prolonged preservation in alcohol causes leaching of specimens converting dark browns to pale yellows. Hence in this part of species descriptions to follow mention is made of the method of preservation as a reference point for comparison and future descriptions. Although critical point drying has removed the problem of shrinkage there is still a tendency for the heads of females to fold transversely along the line in front of the ocellar plate. This occurs also in some males, which gives a false impression of head shape and proportions. For this reason all L:W proportions were taken from slide mounted specimens. Care was exercised in the preparation of slide material not to over-inflate the specimens during clearing and critical point dried specimens were used as a check that this did not happen. The only L:W proportion not taken from slides is that of the prothorax.

In males, most of the characters that proved useful in separating species have functional significance in courtship. The following features were of use: head shape (frontal and lateral), clypeal margins, mandibles, palps, antennal scapes (plus shape and position of pheromone gland, Dahms (1983b)), relative proportions of funicle segments, distribution of multiporous plate sensilla on the flagellum (MPS formula), presence or absence of a short setal tuft ventrally on the fore trochanters, presence or absence of a very long setal tuft ventrally on the mid trochanters, distribution and differentiation of the long setal fringe ventrally on the mid femora, shape of fore wings, shape of stigmal vein if present. In general, the male mesosoma in dorsal aspect lacks many of the sutures present in the female except for *M. clavicornis* where all are present.

In females, the differences useful for separating species appear to have no functional differences related to courtship except perhaps setation of the eyes and the breadth of separation of the facial grooves (Courtship Dahms, 1983a). The following features were of use: head shape and proportions in frontal aspect, eye setation, degree of convergence of the frontal lines and the distance apart of the upper arms, scrobe length, clypeal margins, mandibles, palps, antennal scape proportions, scape and pedicel colour, number of multiporous plate sensilla per segment of flagellum (MPS formula), position of subterminal seta on terminal nipple of club segment 3, proportions of nipple, mesosomal proportions and sculpture patterns in dorsal aspect, number of setae on scutellum, wing shape, ratio of submarginal to marginal vein length, and shape of stigmal vein.

Stigmal veins of females show slight variations in each species and the figures 127–139 are of the most common shape. Apart from the usefulness of the nipple on club segment 3 and the setae on this nipple in females, the proportions of the segment itself proved useful. Since the margin between club segment 2 and 3 is undulating, the proportion is worked out on the shortest length and the ratio becomes shortest length to width.

The MPS formula is slightly variable (± 1) and the figures given in the descriptions represent the maximum counted for 4 antennae in each species. Care should be exercised when counting them as those on the margins of a segment can be easily overlooked and those which wrap around segments (as in female funicular segments) may be counted twice. In all cases descriptions are based upon the type-form only (Polymorphism Dahms, 1983a). Holotype and lectotype selection where possible has been made on the male since, of the sexes, this is the more distinctive.

References given at the start of each description are taxonomic only. Those dealing with biology occur in Dahms (1983a) as do references to recorded hosts. The following abbreviations are used for institutions.

ANIC: Australian National Insect Collection, C.S.I.R.O., Canberra; Australia.
BM(NH): British Museum of Natural History, London, England.
CU, NY: Cornell University, New York, USA.
DPIQ: Queensland Department of Primary Industries, Brisbane.
DSIR: Department of Scientific and Industrial Research, Christchurch, New Zealand.
HDA: Hawaiian Department of Agriculture, Honolulu, Hawaii.
KU: Kyushu University, Kyushu, Japan.
MCZ: Museum of Comparative Zoology, Harvard, USA.
MDA: Museum de La Plata, La Plata, Argentina
MNHP: Musée National d'Histoire Naturelle, Paris, France.
NMC: National Museum (Nat. Hist.), Prague, Czechoslavakia.
QM: Queensland Museum, Brisbane, Australia.

UCR: University of California, Division of Biological control, Riverside, California, USA.
UG: University of Georgia, Athens, Georgia, USA.
USNM: United States National Museum, Washington D.C., USA.

NEW COMBINATIONS

Two species previously referred to the genus *Melittobia* were found to be misplaced. These are redescribed in their correct genera.

GENUS *TACHINOBIA* BOUČEK 1977

Type-species: *Tachinobia repanda* Bouček, 1977 : 27.

Tachinobia diopsisephila (Risbec, 1956)

(Figs 23, 24, 26–31)

Melittobia diopsisephila Risbec, 1956 : 118.
Tachinobia diopsisephila (Risbec). COMB NOV
Tachinobia gradwelli Bouček, 1977 : 28. SYN NOV

This species, only known from females, can be readily separated from the genus *Melittobia* by the following features: head slightly wider than long, vertex almost flat, non-delimited ocellar area, upper facial lines wider than posterior ocelli, shape of clypeus and mandible, pronotum shorter than wide, undifferentiated setae on the mid lobe of mesoscutum, scutellum lacking submedian and sublateral grooves, wings with relatively longer setation and postmarginal vein barely developed or absent.

There is considerable agreement between Risbec's specimens and the description of *T. gradwelli* by Bouček (1977); lower frontal lines separated by twice the diameter of the median ocellus and meeting distinctly below the middle of the eyes, malar space almost equal to mouth breadth, antennal toruli below lower eye margin; setation on dorsal mesosoma more sparse and shorter than *T. repanda,* the type species, fore wings about 2.8 times longer than wide, stigmal vein not much longer than the longest marginal fringe. I have subsequently examined the holotype of *T. gradwelli* and confirmed this synonymy.

Dry and slide mounted specimens of *T. diopsisephila* clearly show the vertex delimited by a groove passing from the eyes to the ocelli. In his description of the genus *Tachinobia,* Bouček (1977) makes no mention of a groove across the vertex and his figure of the dorsal head of *T. repanda* does not show a groove. Slide mounted material I have made of *T. repanda* do not show this groove either. However, examination of ethyl alcohol specimens of *T. repanda* clearly show this groove (Fig. 25) and dry specimens of an undescribed species (USNM 0ollection) also have this groove. This feature should therefore be added to the generic description of *Tachinobia.*

MATERIAL EXAMINED

Holotype ♀, '*Tachinobia gradwelli* Bouček (1977)', 'Venezuela, Estado Aragua Turmero 500 mts, xii.1948, H.E. Box', 'Hyper of *Paratheresia claripolopus* (Wulp) ex *Diatraea lineolata* (Walker) in *Zea mays* '.

Four microscope slides containing a total of 24 specimens dry-mounted under coverslips sealed with wax. I have remounted 6 specimens from 2 slides either on cards or in Euparal on the original slides. Details of the labels and remounts are as follows:

1) *Melittobia diopsisephila* Risbec ex dipt. par. de *Diopsis thoracica,* Garoua 12.54, Descamps 213'. (2 ♀♀ cleared and remounted in Euparal on the original slide) (Garoua is in the Cameroon, W. Africa).
2) *Melittobia diopsisephila* Risbec, epip. de *Diopsis thoracica* ex dip. par., Descamps 200, Garoua'. (15 ♀♀ under one coverslip and a fragmentary head under a separate coverslip).
3) *Melittobia diopsisephila* Risbec ex pupa *Pachylopus* sp., Descamps 243, Garoua, 3.54'. (4 ♀♀ remounted; 2 separately on cards, one of which is selected as lectotype, the remaining 2 cleared and mounted in Euparal on the original slide).
4) as (3). (7 ♀♀).

There is some disparity between Risbec's published notes and the information on his labels; notably the lack of the name *Steleocerus lepidopus* Becker on his labels and absence of the label name *Pachylopus* in his published account. Neave (1939) lists *Pachylopus* as a genus of Coleoptera which seems doubtful as a host. A few names before *Pachylopus* in Neave is *Pachylopus* a genus of Chloropidae which is more likely to be the true host. *Steleocerus lepidopus* is not mentioned on the labels, but is a chloropid fly. My examination of the series shows 24 specimens plus some cylindrical debris which Risbec may have counted to bring his total to 25. I feel that these 4 slides represent his syntypical series of *T. diosisephila* with some error with respect to the chloropid host. From this series a lectotype has been selected and card mounted on a pin. The remaining specimens are on slides and selected as

paralectotypes. Labels have been attached indicating these selections and the specimens reside in the collections of the Musée National d'Histoire Naturelle, Paris.

GENUS *CIRROSPILUS* WESTWOOD, 1832

Type-species: *Cirrospilus elegantissimus* Westwood, 1832

Cirrospilus (Atoposomoidea) cosmopterygi (Risbec)

(Figs 32–37)

Melittobia cosmopterygi Risbec, 1951 : 90
Cirrospilus (Atoposomoidea) cosmopterygi (Risbec, 1951) COMB. NOV.

Females of this species are readily separated from the genus *Melittobia* by their colouration, lack of facial grooves, non-delimited ocellar area, non-emarginate clypeus, antennal insertions above lower margins of eyes, 2 segmented funicle, terminal style of club without a terminal seta and with more than 3 subterminal setae, scutellum squarish with only 2 longitudinal grooves, wings with admarginal setae, long marginal fringe and relatively longer discal ciliation on the fore wing.

The black and yellow colouration is typical of *Cirrospilus*. Using Peck, Bouček and Hoffer (1964) the species keys readily to *Cirrospilus (Atoposomoidea)*. De V. Graham's key (1959) also easily places the species in *Cirrospilus*. Risbec (1951) in his collecting data states that *C. cosmopterygi* was bred from leaf mining lepidopterous larvae; a typical host of *Cirrospilus*. This type of host is not recorded for *Melittobia*.

There has been some difference of opinion as to the status of *Atoposomoidea*, e.g. Delucchi (1958) treats *Atoposomoidea* as a genus. Other workers, e.g. De V. Graham (1959), Bouček (1959) and Kerrich (1969) place it as a sub-genus of *Cirrospilus*. This question is beyond the scope of the present work and it has been decided to follow the direction of Bouček (1959) and leave it as a sub-genus of *Cirrospilus*.

The following redescription has been based upon the syntypical material of Risbec; no other specimens being available. The two females are not cleared and are badly flattened on a microscope slide.

Female: 1.4 mm long; head, antennae brown; mesosoma yellow with black markings (Fig. 33); legs yellow; wings hyaline; metasoma yellow with 2 transverse black bands dividing metasoma equally into thirds.

Head in frontal aspect (Fig. 32); 0.3 mm wide, length to width about 1:1; vertex collapsed, clearly elevated above eyes, not immargined, not vaulted as in *Zagrammosoma* Schulz; POL approximately equals OOL. Eyes dark, probably red in life, oval, sparsely pilose, closer to vertex than clypeus. Clypeus concave, not emarginate. Antennae (Figs. 34, 36); inserted above level of lower eye margins; scape cylindrical, 3.25 times longer than wide, slightly arched in lateral view; pedicel expanded distally, equal to funicle 1; ring joint compound, of several lamellae; funicle 2-segmented, 1 and 2 cylindrical, equal in length; club 3-segmented, 1 and 2 cylindrical, equal in length, 3 shorter, conical bearing a terminal style with 5 subterminal setae but without a terminal seta. Head lateral and dorsal aspects not visible.

Mesosoma (Fig. 33) in dorsal aspect; pronotum large, slightly wider than long, campanulate; posterior border with four large setae, inner pair closer to one another than to pair at posterior lateral angles. Mesoscutum with clearly defined, sigmoidal parapsidial sutures; mid lobe with 2 pairs of long setae, anterior pair finer and closer together than posterior pair; axillae advanced; scutellum large, wider than long, more angular than in *Melittobia*, posterior margin convex; one pair of sublateral grooves anteriorly in line with posterior parapsidial sutures; 2 pairs of long setae situated on the lateral lobes; 1 pair about mid-way and 1 pair on posterior margin. Dorsellum triangular, apex directed posteriorly, base anteriorly convex. Propodeum appears shallowly inclined, without carinae, length at mid line approximately 1/6 width at posterior lateral angles. Wings hyaline (Fig. 35); fore wings about 2.6 times longer than wide, costal margin almost straight, slightly curved at junction of parastigmal and marginal veins; submarginal 0.27 mm long, postmarginal 0.04 mm long, stigmal 0.06 mm long; submarginal veins with 6 long, erect setae in both specimens; costal cell with 9–10 setae ventrally plus two anterolateral setae dorsally; discal ciliation even, moderately long; 8 long, admarginal setae posteroventrally of marginal vein; marginal fringe long. Hind wing narrow,0.75 mm long × 0.09 mm wide; apex acute; marginal fringe longer than fore wing marginal fringe;

stigmal vein absent. Lateral aspect not visible.

Metasoma in dorsal aspect, ovoid, 0.69 mm long × 0.35 mm wide, more acute posteriorly; ovipositor over half length of metasoma, not extruded. Lateral aspect not visible.

Male: Unknown

MATERIAL EXAMINED:

One slide bearing 2 ♀♀, 2 pupal cuticles plus one pupa '*Melittobia cosmopterygi* Risbec, Syntypes; Eulophinae, G.B., ex *Cosmopteryx attennatella,* III .77'.

In his paper, Risbec (1951) gives the locality as M' Bambey, Senegal, and mentions further specimens from *Cosmopteryx* in Niebe. However, he goes on to state that the Niebe material was not in his possession at the time of description. I have been unable to locate the Niebe material and have taken the slide above to include the entire syntypical series. The two specimens on this slide fit Risbec's description of *C. cosmopterygi.* The specimen closest to the Risbec label is selected as the lectotype and the other as the paralectotype. The slide has been labelled accordingly and it is to be found in the collections of the Musée National d'Histoire Naturelle, Paris.

GENERIC DIAGNOSIS

GENUS *MELITTOBIA* WESTWOOD, 1847

Type-species:*Cirrospilus acasta* Walker, 1839 by synonymy with *Melittobia audouinii* Westwood, 1847

Melittobia Westwood, 1847. Type-species, *Melittobia acasta* (Walker, 1839) by synonymy.

Anthophorabia Newport, 1849. Type-species, *Anthophorabia retusa* Newport by monotypy.

Philopison Cameron, 1908. Type-species, *Philopison clavicornis* Cameron, 1908 by monotypy.

Sphecophagus Brèthes, 1910. Type-species, *Sphecophagus sceliphronidis* Brèthes, 1910 by monotypy.

Sphecophilus Brèthes, 1910. 311, new name proposed for *Sphecophagus,* Brèthes.

Generic Description:

Female: Black to dark brown, shining in most species; moderately setose; 1–1.6 mm long.

Head in frontal aspect (Figs 38–48); variable in shape, about as long as wide with alutaceous sculpturing in most species; vertex elevated above eyes, rounded; facial grooves present, converging ventrally to antennal scrobes, distance between upper arms and degree of convergence variable; antennal scrobes shallow, area between slightly raised; clypeus mostly bilobed, rarely truncate emarginate (Figs 59–69); mandibles (Figs 49–58) tridentate, anterior tooth the largest, acute; palps 1-segmented (Figs 70–81). In lateral aspect (Fig. 3); very narrow, converging ventrally; eyes oval, longer than wide; genae well developed, genal sulci absent. In dorsal aspect ocelli arranged in a shallow triangle positioned on an ocellar plate delimited by grooves; vertex with transverse grooves connecting the ocellar plate to the eyes. Antennae (Figs 82–101); 8 segmented plus 1 compound ring joint, inserted below eyes; toruli closer to one another than to eyes; scape nearly reaching top of eyes, elongate, slighly expanded distally, dorsoventrally flattened, ventrally slightly concave; pedicel pyriform, sub-equal to funicle 1; ring joint thin, compound, of 4 lamellae; flagellum dorsoventrally flattened; funicle 3-segmented, segments sub-equal, about as long as wide, all bear MPS; club 3-segmented, all bearing MPS, segment 2 longest, segment 3 shortest (Figs 102–114), conical with terminal nipple, in some species nearly as long as segment 3; terminal nipple with 2–3 setae shorter than nipple, 1 terminal, the others of variable position from 1/2 way down nipple to base.

Mesosoma in lateral aspect (Fig. 3) relatively flat, prothorax triangular. In dorsal aspect (Figs 1, 4) prothorax large, slightly wider than long, campanulate, posteriorly fringed with relatively long, recurved setae; mesoscutum without a longitudinal median groove, parapsidial sutures well defined; mid lobe contracting posteriorly, posterior margin truncate with 1 large recurved seta at each posterior lateral angle; axillae advanced, acute anteriorly, well defined on mesoscutal and scutellar margins; scutellum transverse, submedian and sublateral grooves present, evenly spaced, inner lobe bearing at least 1 pair (rarely more) of large, recurved setae along outer margin of each submedian groove; dorsellum well defined in non-collapsed specimens, ovoid; propodeum

normally developed, wider than long, not steeply inclined, without a median, longitudinal carina; spiracles freely exposed, round; legs normal, fore and hind coxae the longest, hind coxae the broadest; fore wings (Figs 115–126); normal tetrastichine type, hyaline, discal ciliation evenly scattered, setal lines occur along basal, cubital and subcubital vein positions; submarginal vein shorter than marginal, with 4–6 long setae; postmarginal vein poorly developed; marginal vein fringed with long setae which extend to end of postmarginal vein; remaider of wing around apex to distal subcubital setal line fringed with short setae, the fringe longest on posteroapical margin; stigmal vein short (Figs 127–139), just longer than postmarginal; uncus well developed; hind wings narrow, apex acute; postmarginal and marginal vein not developed; fringed with very long setae from end of marginal vein around apex and along posterior margin.

Metasoma elongate, sides sub-parallel, segments of fairly even size; ovipositor not exserted.

Male: Brachypterous, 1.0–1.5 mm long, dark brown to honey yellow in colour.

Head in frontal aspect (Figs 151–160) variable in shape, inflated, wider than long in most species, facial lines absent; clypeus mostly bilobed, rarely truncate emarginate; mandibles tridentate, anterior tooth as in female but much larger (Figs 161–173); palps 1 segmented (Figs 174–184). In lateral aspect (Fig. 2) greatly inflated; eyes reduced to scar-like spots; genal sulcus absent. In dorsal aspect (Fig. 1) ocelli variously reduced; delimiting lines around ocelli and across vertex absent in most species. Antennae (Figs 185–219) greatly modified, 9 segmented, in some a 10th appearing at ring joint (Fig. 202); scape enormously developed, longer than pedicel plus funicle, pyriform to subpyriform, ventrally with either a groove running full length or a distal cup-shaped depression; pedicel produced laterally to form a cap over the distal end of the scape groove or cup; ring segment, compound, thin or in some cases expanded; funicle 4 segmented, with or without plate organs, size and shape of segments variable; club 3-segmented, segments of variable size, terminal segment with a small terminal nipple hardly differentiated in some species; terminal nipple with 2 setae.

Mesosoma of different proportions from female (Fig 1); in lateral aspect flattened, prothorax triangular. In dorsal aspect prothorax large, wider than long, campanulate, posteriorly fringed with relatively long recurved setae, mesoscutum reduced, much wider than long, parapsidial sutures in most species indefinite anteriorly; 1 pair of strong recurved setae on posterior margin; axillae poorly delimited in most species; scutellum in most species without submedian or sublateral grooves, with 4 (rarely more) stiff recurved setae; dorsellum well defined in non-collapsed specimens, more rounded than in female; propodeum well developed, not steeply inclined, smooth, median longitudinal carina absent; spiracles freely exposed, rounded; legs sturdier than in female, fore coxae broad, fore tarsi with at least segments 3 and 4 fused; mid tibiae and in some species mid trochanters ventrally fringed with long setae (Figs 220–230); fore wings reduced (Figs 231–241), of variable width, never longer than mesosoma; marginal vein longer than submarginal; postmarginal and stigmal veins poorly developed; long stiff setae along submarginal and marginal veins, hind wings very reduced, elongate; postmarginal and stigmal veins absent, setation reduced.

Metasoma (Fig. 1) in lateral aspect arched; in dorsal aspect ovoid in life becoming flattened on drying; segments evenly proportioned.

Keys for Identification

Females

1) Facial grooves running separately to scrobes (Figs. 38–45, 48) 2

Facial grooves meeting just above middle of eyes then passing as one line to scrobes, upper arm equal to or wider than POL (Figs. 46, 47) 10

2) Scape and pedicel dark, concolorous with flagellum (Figs. 83, 84), fore wing with costal margin almost straight (Fig. 116) .....*acasta* (Walker)

Scape and pedicel paler than flagellum, fore wing coastal margin noticeably bent at junction with parastigmal vein 3

3) Head broad, length to genal width about 1.1:1 (Figs. 38, 41) 4

Head relatively narrow, length to genal width greater than 1.1:1..... 5

4) Upper arms of facial grooves widely separated, approximately equal to POL, lower arms of facial grooves separated by a distance equal to the diameter of the median ocelleus (Fig. 38), clypeal lobes with small lateral undulations (Fig. 59), subterminal seta on antennal nipple situated basally (Fig. 102) ..... *clavicornis* (Cameron)

Upper and lower arms of facial grooves much closer than above (Fig. 41), clypeal lobes without lateral undulations (Fig. 62), subterminal seta on antennal nipple not basal (Fig. 105)..... *scapata* SP. NOV.

5) Eyes densely clothed with long setae (Figs. 44, 48) 6

Eyes relatively bare, with a few short scattered setae..... 7

6) Head and mesosoma densely setose (Fig. 44); clypeal margin bilobed, lobes narrow each with a small, lateral, lobe-like undulation (Fig. 65); nipple on club segment 3 with 1 subterminal seta (Fig. 108) .... *chalybii* Ashmead

Head and mesosoma not as densely setose (Fig. 48); clypeal margin bilobed, lobes broad, without a small, lateral, lobe-like undulation (Fig. 69); nipple on club segment 3 with 2 subterminal setae (Fig. 114) ..... sp. nov. Argentina

7) Terminal seta on postmarginal vein noticeably longer than those on marginal vein (Figs. 129, 131), head sculpture normal, surface shining..... 8

Terminal seta on postmarginal vein not noticeably longer than those on marginal vein (Figs. 132, 134), head sculpture fine, surface dull, shagreened 9

8) Clypeal margin bilobed each lobe without a lateral, lobe-like undulation (Fig. 61); sculpture pattern on mesoscutum and scutellum very open (Fig. 142); mid lobe of scutellum broad, L:W 1.4:1; MPS formula on flagellum 355:553..... *evansi* SP. NOV.

Clypeal margin bilobed, each lobe with a lateral, lobe-like undulation (Fig. 63), sculpture pattern on mesoscutum and scutellum mid lobes less open particularly on scutellum (Fig. 144); mid lobe of scutellum narrow, L:W 1.9:1 MPS formula on flagellum 567-653..... *digitata* SP. NOV.

9) Scape and pedicel yellow-brown, dorsally dark, reddish-brown (Fig. 90); nipple on club segment 3 long, L:W 4:1, subterminal seta on antennal nipple not basal (Fig. 107) ..... *femorata* SP. NOV.

Scape and pedicel yellow-brown, not strongly darkened dorsally (Fig. 93); nipple on club segment 3 short, L:W 2.5:1, subterminal seta almost basal (Fig. 109) ..... *Megachilis* (Packard)

10) Clypeus bilobed (Fig. 67); upper arms of facial grooves wider than POL (Fig. 47).....11

Clypeus truncate emarginate (Fig. 68); upper facial grooves as wide as POL (Fig. 46) ... *australica* Girault and *hawaiiensis* Perkins

11) Submarginal vein with 5 setae; proximal pair distinctly shorter than rest. *assemi* SP. NOV.

Submarginal vein with 5 long setae of equal length ..... *sosui* SP. NOV.

Males

1) Scape ventrally with a distal cup-shaped depression (Fig. 19) 8

Scape ventrally with a longitudinal groove (Figs. 16-17)..... 2

2) Head large (Fig. 151) dark brown; scape yellow, distinctly club-shaped (Figs. 185, 186), ventral groove shallow; glandular area large, circular ..... *clavicornis* (Cameron)

Head and scape concolorous, yellow-brown; not distinctly club-shaped as (Fig. 151), scape groove deep; glandular area not circular 3

3) Head transversely elliptical, lateral margins broadly rounded (Fig. 158); funicular segmental proportions (Fig. 208), 1 the smallest, narrow, 2+3 the largest, 4 cup-shaped, closely applied to club segment 1; clypeus without lobes..... 4

Head more or less rectangular (Figs. 159, 160); funicular segmental proportions not as above..... 5

4) Flange overhanging scape groove on the side of pedicel attachment with up to 5 setae, only 1 or 2 of which are on the inner margin, 1-2 setae on the proximal floor of groove (Fig. 206)..... *australica* Girault

Flange overhanging scape groove with more than 5 setae of which most are on the inner margin, flange longer than *australica* or Kauai, 4 setae on the proximal floor of groove (Fig. 209)..... *hawaiiensis* Perkins

Flange overhanging scape groove with more than 5 setae spread evenly along flange, most of which are on the inner margin, 2 setae on the proximal floor of groove, (Fig. 210) ..... Kauai

5) Fore wing apex acute (Fig. 239) 6
Fore wing apex rounded (Fig. 241) 7

6) Mid femoral fringe sparse (Fig. 228) ..... *assemi* SP. NOV.
Mid femoral fringe denser (Fig. 230) ..... *sosui* SP. NOV.

7) Mandibles very broad (Fig. 173), projecting well below clypeus when closed; face below toruli with tufts of long, stiff setae (Fig. 160); Maxillary palp broad, distally excavated (Fig. 184); clypeus with 2 broad lobes ..... sp. nov. Argentina
Mandibles not projecting well below clypeus when closed; face below toruli without stiff setae, maxillary palp tapered distally as *assemi* (Fig. 182); clypeal margin with narrow lobes as *assemi* (Fig. 159).. *bekiliensis* Risbec

8) Distal scape margin deeply excavated to produce a thumb-like appendage (Figs. 197, 198)..... *digitata* SP. NOV.
Distal scape margin not as deeply excavated 9

9) Distal scape strongly oblique with a broad excavation overhung by a long setal fringe (Figs. 188, 189)..... *acasta* (Walker)
Distal scape not strongly oblique 10

10) First funicular segment only slightly wider than segments 2–3 (Figs. 193, 196).....11
First funicular segment much wider than segments 2–3; the distal ring-joint expanded slightly to give a small segment before funicle 1 (Figs. 202, 205) 12

11) Fore wing relatively narrow, L:W 2.6:1; costal cell long, L:W 8:1 (Fig. 233); marginal to submarginal vein length 1.4:1; mid femoral fringe relatively even, longest setae about as wide as femur (Fig. 223); head narrowed above eye spots (Fig. 153) L:W 1:1..... *evansi* SP. NOV.
Fore wing relatively broad, L:W 2.4:1; coastal cell shorter, L:W 7.5:1; (Fig. 234) marginal to submarginal vein length 1:1; mid femoral fringe of uneven length, proximal half shorter, just shorter than width of femur, distal half longer, about 1.5 times width of femur (Fig. 222); Head not contracted above eye spots, wider than long, L:W 1:1.3 (Fig. 154)..... *scapata* SP. NOV.

12) Fore wing relatively narrow (Fig. 237), L:W 2.9:1, posterior margin almost straight; coastal cell long, L:W 11.7:1; mid femoral fringe uneven, proximal 1/3 shorter than width of femur, distal 2/3 about as wide as femur (Fig. 226); head densely setose, genae below eye spots contracting to clypeal margin (Fig. 157) ..... *chalybii* Ashmead
Fore wing relatively broad, L:W 2.6:1; costal cell short, L:W 7.6:1 (Fig. 236); mid femoral fringe uneven, proximal 1/2 of fringe about as long as width of femur, distal 1/2 of fringe dense, extremely long nearly 2 x width of femur (Fig. 225); head not as densely setose, genal margins below eye spots straight, parallel, not contracting towards clypeus (Fig. 156)..... *femorata* SP. NOV.

SPECIES DESCRIPTIONS

Melittobia clavicornis (Cameron)

(Figs 38, 49, 59, 70, 82, 102, 115, 127, 140, 151, 161, 174, 185, 186, 187, 220 231)

Philopison clavicornis Cameron, 1908 : 559.
Melittobia clavicornis : Ferrière, 1933 : 103.
Melittobia japonica Masi, 1966 : 38, SYN NOV.
Melittobia japonica : Iwata and Tachikawa, 1966 : 6.
Melittobia japonica : Domenichini, 1966 : 57.

TYPE SPECIMENS:

I have examined the syntypical series of Cameron which is in the collections of the British Museum (Natural History) London. Details are in the MATERIAL EXAMINED section. I have examined also the syntypical series of *M. japonica* Masi which are in the collections of the Kyushu University, Kyushu Japan. From both these syntypical series I have selected lectotypes. Details occur in the MATERIAL EXAMINED section.

DISTRIBUTION:

Borneo, Ceylon, Japan (= species 3, van den Assem and Maeta (1978) = Species 1 van den Assem, Bosch and Prooy (1982)).

DESCRIPTION:

Female: Critical point dried specimens 1.3–1.4 mm long. Head, antennal flagellum, mesosoma, coxae dark brown; trochanters, proximal 2/3 femora, metasoma paler brown; scape, pedicel, remainder of legs yellow-brown.

Head in frontal aspect (Fig. 38) relatively broad, length to genal width 1.1:1; genal-clypeal margin broadly rounded; clypeal margin (Fig. 59) bilobed, each lobe with a small lateral lobe-like undulation; eyes

relatively bare, with a few short scattered setae. Facial grooves remaining separate to meet scrobes well below middle of eyes, upper arms widely separated, maximum distance between arms 3.5 times diameter of median ocellus, greater than POL, converging gradually to scrobes remaining broadly separated but contracting suddenly just before scrobes. Scrobes relatively short, scrobe to eye length 1:3. Mandibles (Fig. 49); anterior tooth long, narrow, 2 and 3 well defined, 2 the more definite. Maxillary palps (Fig. 70) elongate, cylindrical, L:W 5:1. Antennae (Fig. 82); scape L:W 3.7:1; MPS formula on flagellum 354:773; club segment 3 (Fig. 102) shortest length to width 1:2.5; nipple short, broad, L:W 3:1, barely reaching above the MPS; subterminal seta basal.

Mesosoma in dorsal aspect. Setation relatively long. Prothorax wider than long, L:W 1:2. Posterior margin of mesoscutum mid lobe 1.4 times wider than anterior margin of scutellum. Scutellum mid lobe L:W 1.7:1; 1 pair of setae on each submedian lobe, posterior seta almost on hind margin. Sculpture pattern on mid lobes of mesoscutum and scutellum (Fig. 140). Propodeum in dry specimens rectangular, wider than long; posterior margin truncate emarginate; posterolateral angles 90°. Fore wings (Fig. 115); costal margin noticably angled at junction with parastigmal vein; L:W 2.2:1; marginal to submarginal vein length 1.3:1; marginal to stigmal vein length 3.4:1; submarginal to stigmal vein length 2.7:1; stigmal vein (Fig. 127); terminal seta on postmarginal vein as long as those on marginal vein.

Male: Critical point dried specimens 1.4 mm long. Head, body and legs dark brown, head darkest; scape and legs pale yellow-brown.

Head in frontal aspect (Fig. 151) large, slightly wider than long, L:W 1:1.1; vertex depressed medially; lateral margins more or less broadly rounded, slightly contracted below eye spots; clypeal margin bilobed, lobes broad. Mandibles (Fig. 161); anterior tooth of moderate length, relatively close to second, third tooth poorly defined. Maxillary palps (Fig. 174) elongate, cylindrical, slightly curved, L:W 4.8:1. Antennae (Figs. 185–187); scape strongly club-shaped, scape to head length 1:1.8, L:W 1.6:1; ventral surface with a shallow groove, distally truncate not excavated, glandular area large, circular; funicular segment proportions (Fig. 187) 1 very large, L:W 1:1.8, 2–4 sub-equal, relatively small, about as wide as length of segment 1; MPS formula on flagellum 0122:342.

Mesosoma in dorsal aspect. Prothorax L:W 1:2. Mesoscutum with clearly defined parapsidial sutures; axillae well defined. Scutellum without submedian grooves; sublateral grooves present; 2 pair of large setae present, situated as in female.

Fore trochanters without a ventral tuft of short, stiff setae; tarsal segments 3 + 4 fused. Mid legs (Fig. 220); trochanters without a dense tuft of long, fine setae; femora with a cluster of long, fine setae distally, a few short setae proximally; mid femur L:W 2.7:1; mid tibia relatively short and wide, shape quite distinctive, L:W 2.3:1; mid tarsal joints unfused. Fore wings (Fig. 231) broad, L:W 2.5:1; marginal to submarginal vein length 1.2:1; stigmal vein well developed; costal cell L:W 9:1, costal margin slightly arched.

MATERIAL EXAMINED:

BM(NH) 1 ♂ on a card, minus wings; left antennal flagellum separated; dark blue BM 'LECTOTYPE' label, 'Kuching Nov. 07 J.H.', 'This also from *Pison sarawakensis* cocoons', '*Philopison clavicornis* Cameron Type Borneo', 'B.M. TYPE HYM 5.1354'. LECTOTYPE.

1 ♂ glued ventral surface down on a card (only 1 leg attached, and 1 leg glued separately on the card; only 1 fore wing present — torn); blue BM 'PARA-LECTOTYPE' label, 'Kuching, Nov. 07, J.H. P. Cameron Coll., 1914–100', '*Philopison clavicornis* Cam., Type, Borneo'. PARALECTOTYPE.

1 ♀ glued on a card, intact; blue BM 'PARALECTOTYPE' label, '*Philopison clavicornis* Cam.', 'Kuching J.H.', 'Borneo, J. Hewitt, 1910–380'. PARALECTOTYPE.

2 ♀♀ glued ventral surface down on a card, both incomplete (outer minus metasoma, all wings except 1 hind wing separated in the glue; 1 antenna complete, the other separated, fragmentary : inner complete except for metasoma); blue BM 'PARALECTOTYPES' label, 'Bred from cocoons of *Pison sarawakensis* Kuching, Nov. 07, J.H.' 'This seems to be same as my J.19 is it not?', 'A.B. 2', '*Philopison clavicornis* Cam., Type, Borneo', 'P.

Cameron collection, 1914-110'. PARALECTOTYPES.
1 ♀ on a card buried in glue; blue BM 'PARALECTOTYPE' label, '*Philopison clavicornis,* Cam. Type Borneo', 'P. Cameron Coll. 1914-110'. PARALECTOTYPE.
1 ♀ on a card, intact, blue BM 'PARALECTOTYPE' label, 'Kuching J.H. [this label has July crossed out]', 'P. Cameron Coll. 1914-110'. PARALECTOTYPE.
11 microscope slides with various parts of both sexes as follows:
Slide 1 — 4 coverslips containing a disembered ♂. '*Melittobia (Philopison) clavicornis,* Cam., ♂', '*Pelopaeus madraspatarum* Borneo, Kuching. (Edinburgh Mus.) J. Hewitt Coll.' PARALECTOTYPE.
Slide 2 — 1 coverslip containing a ♂ head minus mouthparts and antennae. 'Head, ♂, *Melittobia (Philopison) clavicornis,* Cam.', 'Kuching, Borneo Nov. 1907 J. Hewitt 1910-380'. PARALECTOTYPE.
Slide 3 — 3 coverslips containing ♂ antennae and mouthparts. 'Mandibles, Trophi, & Antennae, ♂. *Melittobia (Philopison) clavicornis,* Cam.', 'Kuching, Borneo, Nov. 1907 J. Hewitt 1910-380'. PARALECTOTYPE.
Slide 4 — 1 coverslip containing a ♂ mesosoma + metasoma; minus prothorax, legs, wings and genitalia. 'Meso-Metathorax & Abdomen, ♂ *Melittobia (Philopison) clavicornis,* Cam.', 'Kuching, Borneo Nov. 1907 J. Hewitt 1910-380.' PARALECTOTYPE.
Slide 5 — 1 coverslip containing ♂ wings (2 pairs). 'Wings, ♂. *Melittobia (Philopison) clavicornis,* Cam.', 'Kuching, Borneo Nov. 1907 J. Hewitt 1910-380'. PARALECTOTYPE.
Slide 6 — 1 coverslip containing 1 set of ♂ legs. 'Legs, ♂. *Melittobia (Philopison) clavicornis* Cam.', 'Kuching, Borneo, Nov. 1907 J. Hewitt 1910-380'. PARALECTOTYPE.
Slide 7 — 2 coverslips containing ♂ prothorax and genitalia. 'Prothorax & Genitalia, ♂. *Melittobia (Philopison) clavicornis* Cam.', 'Kuching, Borneo Nov. 1907 J. Hewitt 1910-380'. PARALECTOTYPE.
Slide 8 — 1 large coverslip containing an intact ♀. '♀ *Melittobia (Philopison) clavicornis,* Cam. CO-TYPE', 'Kuching, Borneo J. Hewitt, 1909-182'. PARALECTOTYPE.
Slide 9 — 4 coverslips containing 1 ♀ head with separated antennae and mouthparts. 'Head, Antennae, Mandibles & Trophi ♀ *Melittobia (Philopison) clavicornis* Cam.', 'Kuching, Borneo J. Hewitt 1909-182'. PARALECTOTYPE.
Slide 10 — 4 coverslips containing 1 ♀ mesosoma (minus legs and wings), metasoma and ovipositor. 'Prothorax, Mesothroax, Metathorax, Propodeum, Abdomen & Ovipositor ♀ *Melittobia (Philopison) clavicornis,* Cam.', 'Kuching, Borneo J. Hewitt 1909-182'. PARALECTOTYPE.
Slide 11 — 2 coverslips containing ♀ wings (2 pairs) and legs (1 set). 'Legs & Wings, ♀ *Melittobia (Philopison) clavicornis* Cam.', 'Kuching, Borneo J. Hewitt 1909-182'. PARALECTOTYPE.
The parts on slides 2-7 all make up a single ♂ and were probably from a single specimen, similarly the parts on slides 9-11 may all be from a single ♀.

USNM 2 ♀♀ intact glued on separate cards on separate pins in Dr. K. Krombein's voucher specimen collection and labelled — 'SRI LANKA : Colombo, 3.x.1977, K.V. Krombein, 10377 A, ex *Paraleptomenes mephitis';* a pink label, '10377A'.
1 ♀ 1 ♂ on separate pins with above data; ♂ also labelled '*Melittobia clavicornis* (Cam.), det. Z. Bouček, 1978'.

KU 6 points on one pin, 5 each bearing 1 ♀ (upper minus head) and 1 bearing plant material. These are labelled, '*Melittobia japonica* MS., Cotypi!, det. L. Masi'. From this syntypical series I have selected the female on the bottom point as the lectotype and marked its point with red. The remaining 4 specimens have been selected as paralectotypes. Labels were applied indicating these selections.

QM 2 microscope slides, 1 with 2 ♀♀ the other with 2 ♂♂ and both labelled, '*Melittobia clavicornis* (Cam.) E. Dahms det. 1981, Chiisageta-gun, Nanango Pref., Japan, Jan. 1977, T. Kitamura ex *Trypoxylon malaisei*'.

In addition to these there is a series of card-mounted specimens each with 1 ♂ 4 ♀♀; 'Chiisagata-gun, Nanango Pref., Japan, Jan. 1977, T. Kitamura ex *Trypoxylon malaisei*', '*Melittobia clavicornis* (Cameron), E. Dahms det. 1981'. These are all critical point dried specimens and one card has been deposited in

each of the following institutions: ANIC, BM(NH), DSIR, KU, MDA, MNHP, NMC, QM, UCR and USNM.

NOTES: The figures of this species were taken from the QM slides of specimens from Japan. The syntypical slides came to hand after figures were assembled.

Melittobia acasta (Walker)

(Figs 39, 50, 60, 71, 83, 84, 103, 116, 128, 141, 152, 162, 175, 188, 189, 190, 221, 232)

Cirrospilus acasta Walker, 1839 : 328.
Melittobia audouinii Westwood, 1840 : 160.
Melittobia audouinii : Westwood, 1847 : 18.
Anthophorabia retusa Newport, 1849a : 183.
Melittobia audouinii : Westwood, 1849a : 295.
Melittobia audouinii : Westwood, 1849b : 37.
Melittobia audouinii : Westwood, 1849c : 65.
Anthophorobia retusa : Westwood, 1849c : 65.
Anthophorabia retusa : Newport, 1849b : 513.
Melittobia audouinii : Newport, 1849b : 514.
Melittobia audouinii : Westwood, 1849d : 39.
Anthophorabia retusa : Newport, 1849c : 122.
Melittobia audouinii : Newport, 1849c : 122.
Anthophorabia retusa : Newport, 1852a : 63.
Melittobia audouinii : Newport, 1852a : 65.
Anthophorabia fasciata Newport, 1852b : 81 SYN NOV.
Anthophorabia fasciata : Newport, 1853 : 165.
Melittobia acasta : Smith, 1853 : 248.
Melittobia acasta : Giraud, 1869 : 151, 155.
Melittobia audouinii : Ashmead, 1892 : 228.
Anthophorabia retusa : Ashmead, 1892 : 228.
Melittobia acasta : Dalla Torre, 1898 : 84.
Melittobia acasta : Ashmead, 1904 : 348, 380.
Melittobia acasta : Schmiedeknecht, 1909 : 466.
Melittobia acasta : Morely, 1910 : 57.
Melittobia acasta : Waterston, 1917 : 190.
Melittobia strandi Wolff and Krausse, 1922 : 16 SYN NOV.
Melittobia acasta : Peck, 1963 : 161.
Melittobia acasta : Peck, Bouček and Hoffer, 1964 : 98.
Melittobia acasta : Domenichini, 1966 : 56.
Melittobia acasta : De Santis, 1957 : 109.
Melittobia acasta : De Santis, 1973 : 16.
Melittobia audouinii : Bouček, 1977 : 24.
Melittobia acasta : Bouček, 1977 : 24.
Melittobia audouinii : Gordh, 1979 : 1005.

TYPE SPECIMENS:

I have not seen Walker's type-specimen of *M. acasta* which is in the British Museum (Natural History), London nor have I seen any specimens of Westwood (*M. audouinii*) and Newport (*Anthophorabia retusa, A. fasciata*). The specimens of the last two authors, if they exist, are probably also in the British Museum. My recognition of this species is based upon material identificd by Dr Z. Bouček and the exhaustive redescription by Waterston (1917). It is a distinctive species and there can be little doubt of its identity. Newport (1852b) described the species *A. fasciata* provisionally, in the absence of any of the *A. retusa* specimens for comparison, because new specimens to hand showed characters he could not remember in *A. retusa*. However, from the figures in this paper and his 1853 paper, *A. fasciata* is clearly a junior synonym of *M. acasta*.

The type of *M. strandi* Wolff and Krrausse (1922) could not be located. From their description and figures this species is clearly a junior synonym of *M. acasta*.

DISTRIBUTION:

England, Europe, Japan (= *M. japonica* of Maeta and Yamane (1974)) (= species 1 of van den Assem and Maeta (1978)), South America, Canada (= *chalybii* of Hobbs and Krunic (1971)) and New Zealand, (= species 2 of van den Assem, Bosh and Prooy (1982)).

DESCRIPTION:

Female: Critical point dried specimens 1.4–1.5 mm long; air dried specimens 1.3–1.5mm long. Colour air dried specimens: head, scape, pedicel, flagellum, mesosoma, coxae, trochanters, proximal ⅔ femora, metasoma dark brown, remainder of legs yellow brown.

Head in frontal aspect (Fig. 39) of moderate width, length to genal width about 1.2:1; genal-clypeal margin not as broadly rounded as *M. clavicornis* clypeal margin (Fig. 60) bilobed, lobes broad; eyes relatively bare, with a few short scattered setae. Facial grooves remaining separate to scrobes, maximum distance between arms not as wide as POL, 2.6 times diameter of median ocellus, converging gradually to meet scrobes well below middle of eyes, lower arms separated by a distance 0.5 times the width of median ocellus. Scrobe to eye length 1:2. Mandibles (Fig. 50); anterior tooth relatively short, narrow, middle tooth more prominent than 3, acute, narrow, third tooth broad not as clearly defined. Maxillary palps (Fig. 71) elongate, cylindrical, slightly widest at middle, of moderate length, L:W 4:1.

Antennae (Fig. 84); scape (Fig. 83) narrow, L:W 3.4:1; MPS formula on flagellum 345:563; club segment 3 (Fig. 103) shortest length to width 1:2; nipple elongate, standing well above MPS, L:W 4.7:1; subterminal seta about mid-way down nipple.

Mesosoma in dorsal aspect. Prothorax L:W 1:1.8. Posterior margin of mesoscutum mid lobe 1.2 times wider than anterior margin of scutellum mid lobe. Scutellum mid lobe L:W 1.7:1; 1 pair of setae on each submedian lobe, posterior setae situated forward of posterior margin by a distance of 1/10th length of submedian lobe. Sculpture pattern on mesoscutum and scutellum mid lobes (Fig. 141). Propodeum wider than long, rectangular, posterior margin transverse, emarginate, posterolateral angles 90°. Fore wings (Fig. 116) relatively long, L:W 2.5:1 costal margin almost straight; marginal to submarginal vein length 1.4:1; stigmal vein (Fig. 128), marginal to stigmal vein length 4.8:1, submarginal to stigmal vein length 3.2:1; terminal seta on post marginal vein as long as those on marginal vein.

Male: Critical point dried specimens 1.4–1.7 mm long. Head, antennae, mesosoma, legs and metasoma medium brown except flagellum infuscated, mesoscutum and axillae very pale; vertex, prothorax, scutellum, coxae, trochanters, proximal 2/3 femora, metasoma lightly infuscated. In air dried specimens the colour becomes a fairly uniform medium to dark brown.

Head in frontal aspect (Fig. 152) vertex broad, almost straight especially in air dried specimens, contracting strongly below eye spots to clypeal margin, L:W 1:1.07; clypeal margin bilobed, lobes broad. Mandibles (Fig. 162) elongate, anterior tooth long, narrow, widely separated from second, second and third teeth broad, 2 the largest. Maxillary palps (Fig. 175) elongate, cylindrical, of medium length, L:W 4:1. Antennae (Figs. 188–190); scape club-shaped, less so than *M. clavicornis,* scape to head length 1.1:1, L:W 2:1; ventral surface distally with a deep, cup-shaped depression, glandular area transversely elongate (Fig. 189); distal scape margin strongly oblique, broadly excavated, excavation overhung by long setae (Fig. 188). Funicular segmental proportions (Fig. 190), 1 the largest, L:W 1:1.3; segments 2–4 small, sub-equal, 2 the smallest, width of 2–4 slightly larger than length of 1; MPS formula 0001:342.

Mesosoma in dorsal aspect. Prothorax L:W 1:1.3. Parapsidial sutures and axillae not as well defined as in *M. clavicornis.* Scutellum without submedian grooves, sublateral grooves faintly defined; 2 pairs of setae positioned as in female. Fore trochanters without a dense tuft of short, stiff setae ventrally; tarsal segments 3 + 4 fused. Mid legs (Fig. 221) trochanters with a dense tuft of long, fine setae ventrally; femoral fringe strongly differentiated, proximal half of femora with fringe of setae shorter than width of femur, distal fringe with long setae, slightly longer than width of femur; mid femur L:W 3.8:1; mid tibia shape distinctive, L:W 3.8:1; mid tarsi without fused segments. Fore wings (Fig. 232) broad, L:W 2.6:1; marginal to submarginal vein length 1.4:1; stigmal vein well developed, broad; costal cell relatively broad, L:W 6.7:1, costal margin strongly arched.

MATERIAL EXAMINED:

BM(NH) 12 ♀♀ 'L.S. Kensington, iii.1948, R.B. Benson, B.M. 1948. 145'; 3 ♀♀ 'England, Hants. Basingstoke, Long Sutton, 4.vi.1948, F.D. Goodliffe', 'Com. Inst. Ent. Coll. No. 11069', 'Pres. by Com. Inst. Ent. B.M. 1948 — 550', 'ex leaf cutter bee'; 1 ♂ 'Basingstoke, Hants., 29.vi.1904, A.H. Hamm', '*Melittobia acasta* Wlk. ♂', '♂ *Melittobia acasta* (Walk.) Det. Z. Bouček 1974', 'Bred from *Odynerus sinuatus*'; 4 ♂♂ 'Cambridge, 1915, Dr G.S. Graham Smith', 'J. Waterston Det. *Melittobia acasta* Walk ♂', 'Bred from *Calliphora*'; 2 ♀♀ 'Haywards Heath, Sussex, v.iii.1919, K.G.B. 1919 — 222', 'Bred from Tachinid puparia ex *A. pyramidea*'.

USNM 1 ♀, 4 ♂♂ 'ex *Cnidocampa flavescens*' 'Melrose Hills Mass. 9–29', 'Gip. Moth Lab. 13043'; 3 ♂♂ 'ex Tachinid puparium', 'Phila Pa 9–20–24', 'Gip. Moth Lab 11741 J13'.

QM 2 ♀♀ 1 ♂ on a microscope slide 'Jose C. Paz. Prov. de Bs.As., S/ *Trypoxylon* sp. col. Ibarra Grasso 10/III/1956 ♀ and ♂', '*Melittobia acasta* Det. De Santis'.

NMC 20 ♀♀ 4 ♂♂ 'Boh. Majdalena, Treboh, v.1963 K. Denes', 'ex pupa *Coroebus undatus* F. (Buprestidae)'; 22 ♀♀ 1 ♂ 'Majdalena Bohemia, v.63, lat. K. Denes', 'ex pupa *Coroebus undatus* F. Buprestidae'; 11 ♀♀ 4 ♂♂ 'Bohemia : Sobeslav, ex *Vespa crabro,*

x.1950, K. Pfleger ed'; 5 ♀♀ 'Italia : Sasso, Furbara, 1948, *Sceliphron destill.*'

In addition critical point dried material as follows:

1) 'Losser, Overijssel Prov., Netherlands, 18.vi.1974, G.A. Bekke, ex pompilid.' 4 ♀♀ 1 ♂ in each of the following institutions: ANIC, BM(NH), DSIR, USNM, MNHP, QM, THAES, UCR, USNM.
2) '1 km W. Taitapu New Zealand, 20 March, 1980 R.P. Macfarlane', 'ex nest *Bombus hortorum* nest in box No. C31'' 4 ♀♀ 1 ♂ in each of the following institutions: ANIC, BM(NH), DSIR, QM.
3) 'Morioka Exp. Stn., Iwate Pref., Japan, 1974, Y. Maeta', 'ex *Osmia imaii*' 4 ♀♀ 1 ♂ in each of the following institutions: ANIC, BM(NH), DSIR, KU, QM, THAES, UCR, USNM.
4) 'Lethbridge, Alta, Canada, xi.1974, G.A. Hobbs', 'ex *Megachile relativa*' 4 ♀♀ 1 ♂ in each of the following institutions: ANIC, BM(NH), DSIR, QM, UCR, USNM.

Melittobia evansi SP NOV

(Figs 40, 51, 61, 72, 85, 86, 104, 117, 129, 142, 153, 163, 176, 191, 192, 193, 223, 233)

TYPE SPECIMENS:

The types were selected from a laboratory culture maintained at the University of Georgia, Athens, Georgia, U.S.A. which was established from specimens collected at Athens, Georgia, U.S.A., by D.A. Evans, out of nests of *Trypoxylon striatum.* The holotypc ♂ (marked H on card-mount) is air dried from alcohol and card mounted with 2 ♂♂ 2 ♀♀ paratypes (USNM). Additional paratypes consist of 15 cards each with 4 ♀♀ and 5 cards each with 1 ♂ 4 ♀♀ critical point dried from alcohol and are deposited in the following institutions USNM BM(NH), QM, UCR, UG. The paratypes are rather pale as a result of leaching in alcohol.

DISTRIBUTION:

Athens, Georgia, U.S.A.; Goshen, N.Y., U.S.A. (= species 3 of van den Assem, Bosch and Prooy (1982)).

DESCRIPTION:

Female: Critical point dried specimens 1.1–1.4 mm long. Colour from air dried material ex alcohol. Head, antennal flagellum, mesosoma, coxae, proximal 2/3 femora dark brown; metasoma medium brown; scape, pedicel and remainder of legs yellow-brown. Head in frontal aspect (Fig. 40) relatively narrow, length to width of gena about 1.3:1; genae almost parallel, genal-clypeal margin angled rather than broadly rounded; clypeal margin (Fig. 61) bilobed, lobes broad; eyes relatively bare, with a few short, scattered setae. Facial grooves remaining separate to scrobes, maximum distance between arms about 2.2 times diameter of median ocellus; grooves converge gradually to meet scrobes below middle of eyes, minimum distance between grooves 0.5 times the diameter of median ocellus. Scrobe to eye length about 1:2.5. Mandibles (Fig. 51); anterior tooth long, narrow; second and third well defined, second long, narrow. Maxillary palps (Fig. 72) elongate, cylindrical, relatively long, L:W 5:1. Antennae (Figs 85, 86); scape narrow, L:W 4.2:1; MPS formula on flagellum 355:553; club segment 3 (Fig. 104) length to shortest length 1:1.4, nipple broad, L:W 2.5:1, barely projecting above MPS; subterminal seta just below middle of nipple. Mesosoma in dorsal aspect. Prothorax L:W 1:1.4. Posterior margin of mesoscutum mid lobe 1.2 times wider than anterior margin of scutellum mid lobe. Scutellum mid lobe L:W 1.4:1; 1 pair of setae on each submedian lobe of scutellum, posterior setae on posterior margin of lobe. Sculpture pattern on mesoscutum and scutellum mid lobes (Fig. 142), pattern very open. Propodeum wider than long, posterior margin an open V-shape, posterolateral angles obtuse. Fore wings (Fig. 117) L:W 2.4:1; costal margin bent at junction with parastigmal vein; marginal to submarginal vein lengths 1.5:1; 4–5 setae on submarginal vein; stigmal vein (Fig. 129) marginal to stigmal vein length 4.1:1; submarginal to stigmal vein length 2.8:1; terminal seta on postmarginal vein much longer than those on marginal vein.

Male: Air dried specimens ex alcohol 1.4 mm long. Head, antennae, mesosoma, legs pale brown, head darkest, mesoscutum and axillae palest; metasoma dark brown.
Head in frontal aspect (Fig. 153), L:W 1:1, vertex rounded, narrower than width below eye spots, genae broadly rounded, not contracted, meeting clypeus in an obtuse angle; clypeal margin bilobed, lobes broad. Mandibles (Fig. 163) long, narrow; anterior

tooth very long; second and third well defined, second the longest. Maxillary palps (Fig. 176) elongate, cylindrical, L:W 4.8:1. Antennae (Figs. 191–193) scape club-shaped, less pronounced than *M. acasta,* scape to head length 1:1.6, L:W 1.7:1; ventrally (Fig. 192) with a distal, deep, cup-shaped depression; glandular area transverse expanding on side opposite pedicel attachment; distal scape broadly excavated, very slightly oblique; funicular segmental proportions (Fig. 193) 1 large, L:W 1:1.6; 2–4 sub-equal, width to length of first 1:1.2; MPS formula 0022:232.

Mesosoma in dorsal aspect. Prothorax L:W 1:1.8. Parapsidal sutures and axillae not as clearly defined as in *M. clavicornis.* Submedian grooves of scutellum absent, sublateral grooves faintly marked; 2 pair of setae positioned as in female. Fore trochanters without a ventral tuft of short, stiff, setae; fore tarsi with segments 3 + 4 fused. Mid legs (Fig. 223); mid trochanters with a dense tuft of long, fine setae; femoral fringe evenly distributed along femur, setae of even length, about as wide as femur, mid femur L:W 3.9:1; mid tibia L:W 3.2:1; mid tarsi without fused segments. Fore wings (Fig. 233) broad, L:W 2.6:1, costal and posterior margin almost parallel; marginal to submarginal vein length 1.4:1; stigmal vein well developed, broad; costal cell narrow, L:W 8:1, costal margin slightly arched.

MATERIAL EXAMINED:

Holotype ♂; and paratype ♂♂, ♀♀ from Georgia deposited as in TYPE SPECIMENS section.

USNM 5 ♀♀ 'Goshen, N.Y., 3.22.40, vial 1, R.G. Schmieder', 'Ex *Trypoxylon politum* '; 3 ♀♀ data as above vial 2; 1 ♀♀ 'Goshen, N.Y. 7-27-36, vial 3, R.G. Schmieder', 'Ex *Trypoxylon politum* '. The last specimen is a second form with crumpled wings.

This species is named *evansi* after Dr. D.A. Evans, Kalamazoo College, U.S.A. who brought this species to my attention and has been of help in many other ways.

Melittobia scapata SP NOV

(Figs 41, 52, 62, 73, 87, 105, 118, 130, 143, 154, 164, 177, 194, 195, 196, 222, 234)

TYPE MATERIAL:

Holotype ♂ plus 4 paratype ♀♀ on a single card with the original alcohol labels 'Tompkins Co., N.Y. late Apr., 1974, Suellen Vernoff', 'ex nest *Trypoxylon* ', 'CU Lot No. 1040, site C, Nest 88'; 4 ♀♀ 1 ♂ paratypes on a single card with holotype data (USNM); 22 ♀♀ 2 ♂♂ paratypes with holotype data (CU, NY); 2 ♂♂, 3 ♀♀ paratypes on slides (QM) 'New York, U.S.A., 8.May.1971, G. Eichardt, reared nest of mason wasp. Euparal, E.C. Dahms 1980'.

DISTRIBUTION:

Tompkins County, New York, U.S.A.

DESCRIPTION:

Female: Critical point dried specimens 1.6–1.7 mm long. Head, flagellum, mesosoma, coxae, femora dark brown; scape, pedicel, metasoma, remainder of legs medium brown. These specimens have been in alcohol since 1974 and the antennae have leached. The scape and pedicel were probably fairly dark when fresh but not as dark as the flagellum. Head in frontal aspect (Fig. 41) relatively broad, length to genal width 1.1:1; genae broadly rounded, genal-clypeal margin more or less sharply angled; clypeal margin (Fig. 62) bilobed, lobes broad, relatively long; eyes relatively bare, with a few short setae. Facial grooves remaining separate to scrobes, maximum distance between arms 2.1 times diameter of median ocellus; grooves converging sharply to just above middle of eyes then running close and parallel to meet scrobes well below middle of eyes; minimum distance between arms 0.3 times diameter of median ocellus. Scrobe to eye length 1:2.4. Mandibles (Fig. 52) broad, anterior tooth short, narrow, very widely separated from second; second and third broad, equal. Maxillary palps (Fig. 73) elongate, cylindrical, relatively long L:W 4.6:1. Antennae (Fig. 87); scape narrow, L:W 3.4:1; MPS on flagellum 356:673; club segment 3 (Fig. 105) shortest length to width 1:1.8; nipple relatively broad, L:W 2.6:1; subterminal seta just below middle of nipple. Mesosoma in dorsal aspect. Prothorax L:W 1:1.7. Posterior margin of mesoscutum mid lobe 1.6 times wider than anterior margin of scutellum mid lobe. Scutellum mid lobe L:W 2:1; 1 pair of setae on each submedian lobe, posterior setae on posterior margin of lobe. Sculpture pattern on mesocutum and

scutellum mid lobes (Fig. 143). Propodeum wider than long, posterior margin an open V-shape, posterolateral angles obtuse. Fore wings (Fig. 118) L:W 2.2:1; costal margin bent at junction with parastigmal vein; 5–6 long setae on submarginal vein; marginal to submarginal vein length 1.4:1; stigmal vein (Fig. 130) marginal to stigmal vein length 4.7:1; submarginal to stigmal vein length 3.3:1; terminal seta on postmarginal vein slightly longer than those on marginal vein.

Male: Critical point dried material, 1.4 mm long. Head, body and legs a fairly uniform pale brown; mesosoma lightly infuscated.

Head in frontal aspect (Fig. 154) rounded in shape, genae slightly flattened, L:W 1:1.3; clypeal margin bilobed, lobes broad. Mandibles (Fig. 164); anterior tooth long, narrow, widely separated from second; second and third well defined, relatively narrow. Maxillary palps (Fig. 177) elongate, widest basally, L:W 4.5:1. Antennae (Figs 194–196) more or less evenly expanded distally, length to head length 1:1.6, L:W 1.9:1; ventral surface (Fig. 195) with a distal, deep, cup-shaped depression; glandular area transverse, narrow, relatively small; distal end of scape broadly excavated, only slightly oblique; funicular segmental proportions (Fig. 196) segment 1 the largest, L:W 1:1.6; segments 2–4 smaller, sub equal, not much narrower than segment 1; MPS formula of flagellum 0011:122.

Mesosoma in dorsal aspect. Prothorax L:W 1:1.4. Parapsidial sutures and axillae not as well defined as in *M. clavicornis*. Submedian grooves of scutellum absent, sublateral grooves poorly defined; 2 pair of large setae positioned as in female. Fore trochanters without a ventral tuft of short, stiff setae; tarsal segments 3 + 4 fused. Mid legs (Fig. 222); trochanters with a dense tuft of long, fine setae; femoral fringe of uneven length, proximal half of fringe short, setae a little shorter than width of femur, distal fringe with longer setae about 1.5 times width of femur; L:W femur 4:1; tibia L:W 3.8:1; mid tarsi without fused segments. Fore wings (Fig. 233) broad, L:W 2.4:1; marginal to submarginal vein length 1:1; stigmal vein well developed; costal cell relatively broad, L:W 7.5:1, costal margin arched.

MATERIAL EXAMINED:

Holotype and paratypes as listed in TYPE SPECIMENS section.

This species is named *scapata* to draw attention to the relatively short, narrow scapes in the male.

Melittobia digitata SP NOV

(Figs 42, 53, 63, 74, 88, 89, 106, 119, 131, 144, 155, 165, 178, 197, 198, 199, 224, 235)

TYPE MATERIAL:

Holotype ♂ (indicated by arrow) mounted on a card with 4 ♀ 1 ♂ paratypes '5 mls W. Tallahasse, Florida, U.S.A., J. Trexler, 26.xi.1980, ex *Trypoxylon politum* ' (USNM). 15 ♀, 2 ♂ paratypes 'Leon Co. Fla., U.S.A., from culture begun 11.26.1980' in the following institutions: BM(NH), QM, UCR, USNM.

DISTRIBUTION:

U.S.A. — Florida, Connecticut, Michigan, Texas, Virginia, Mississippi. (= *chalybii* of Buckell (1928), (= species 4 of van den Assem Bosch and Prooy (1982)).

DESCRIPTION:

Female: Critical point dried material. 1.6 mm long. Specimens unleached. Head, antennal flagellum, mesosoma, coxae dark brown; trochanters, proximal 2/3 femora, metasoma lighter brown; scape, pedicel, remainder of legs yellow-brown.

Head in frontal aspect (Fig. 42) relatively narrow, length to genal width 1.4:1; genae long, almost parallel; genal-clypeal margin angled; clypeal margin (Fig. 63) bilobed, lobes broad, each with a small, lateral, lobe-like undulation; eyes relatively bare, with a few, short, scattered setae. Facial grooves separate to scrobes; maximum distance between arms 1.8 times diameter of median ocellus; contracting evenly to meet scrobes below middle of eyes; minimum distance between arms 0.5 times diameter of median ocellus. Scrobe length to eye length 1:1.8. Mandibles (Fig. 53); anterior tooth relatively short, narrow; second and third well defined, second the longest, both relatively acute. Maxillary palps (Fig. 74) elongate, cylindrical, of medium length, L:W 3.8:1. Antennae (Figs 88, 89). Scape narrow, L:W 3.9:1; MPS formula on flagellum 567:653; club segment 3 (Fig. 106) shortest length to width 1:2; nipple relatively broad, L:W 3:1; subterminal seta situated well below half way down nipple.

Mesosoma in dorsal aspect. Prothorax L:W 1:1.2. Posterior margin of mesoscutum mid

lobe 1.3 times wider than anterior margin of scutellum mid lobe. Scutellum mid lobe L:W 1.9:1; 1 pair of setae on each submedian lobe, posterior setae situated on posterior margin of lobe. Sculpture pattern on mesoscutum and scutellum mid lobes (Fig. 144). Propodeum wider than long, posterior margin an open V-shape, posterolateral angles obtuse. Fore wings (Fig. 119) L:W 2.5:1, costal margin bent at junction with parastigmal vein; 4 setae on submarginal vein; marginal to submarginal vein length 1.3:1; stigmal vein (Fig. 131) marginal to stigmal vein length 4.3:1; submarginal to stigmal vein length 3.3:1 ; terminal seta on postmarginal vein longer than those on marginal vein.

Male: Critical point dried specimens 1.5 mm long. Specimens unleached. Head, mesoscutum, axillae, scutellum yellow, paler than rest of body; antennae, remainder of mesosoma, legs pale brown; metasomal segments each with a posterior broad, transverse, infuscated band. In air dried specimens the whole insect becomes a medium brown, metasoma black.

Head in frontal aspect (Fig. 155) vertex broadly rounded, almost straight in air dried specimens; genal margins relatively straight, contracting slightly to an angular genal-clypeal junction; clypeal margin bilobed, lobes broad, well defined. Mandibles (Fig. 165); anterior tooth of median length, broad, well separated from second; second and third teeth well defined, broad, 3 the broadest. Maxillary palps (Figs 178) elongate, cylindrical, of medium length, L:W 3:1. Antennae (Figs 197–199). Scape club-shaped, length to head length 1:1.5, L:W 1.9:1; ventral surface (Fig. 198) with a distal, cup-shaped depression; glandular area elongate, transverse, narrow; distal club margin very deeply excavated producing a thumb-like projection on the side opposite pedicel attachment. Funicular segmental proportions (Fig. 199) 1 largest, L:W 1:1.7; segments 2–4 sub-equal, 2 the smallest; width of 2–4 approximately equal to length of segment 1; MPS formula on flagellum 021:142.

Mesosoma in dorsal aspect. Prothorax L:W 1:1.6. Parapsidial sutures and axillae not as well defined as in *M. clavicornis*. Submedian grooves of scutellum absent, sublateral grooves poorly defined. Fore trochanters without a ventral tuft of short, stiff setae; fore tarsi with segments 3 + 4 fused. Mid legs (Fig. 224); trochanters with a dense tuft of long, fine setae; femoral fringe of uneven length, proximal 1/3 much shorter than width of femur, medial 1/3 about as wide as femur and distal 1/3 about twice width of femur; L:W femur 4.1:1; tibia L:W 3.4:1; mid tarsi without fused segments; setae on tarsal segments relatively long. Fore wings (Fig. 235) broad, L:W 2.7:1; marginal to submarginal vein length 1.2:1; costal cell narrow, L:W 7.6:1, costal margin slightly arched; stigmal vein well developed.

MATERIAL EXAMINED:

Holotype and paratypes as listed in TYPE SPECIMENS section.

USNM 3 ♀♀ 3 ♂♂ 'Connecticut, U.S.A., 6.i.1978, T.M. O'dell', 'ex Lab. culture Tachinid *Blepharipa* sp., U.S. Dep. Agr. & Forest Service'; 3 ♀♀ 1 ♂ 'Gainesville, Fa., 2/17/26', 'ex *Tromotobia rufopectus* on *Argiope* sp.', 'W.A. Murrill coll.'; 2 ♀♀ 1 ♂ 'Norfolk, Va., 5.20.31, L.D. Anderson', 'Reared from larvae and pupae, Sphecoid wasp'; 1 ♀ 4 ♂♂ 'College Station, Brazos Co., Texas, viii.8.1976, Hal Reed'; 40 ♀♀ 9 ♂♂ 'Hillsdale, Michigan, U.S.A., Sept. 1977, B.K. Nübel', 'ex *Megachile* sp. nesting in old *Trypoxylon* nests'; 1 ♂ 'State College, Miss., Ex sphecidae, R.E. Hutchings'.

QM 3 ♀♀ 2 ♂♂ on microscope slides with the Hillsdale data above.

This species has been named *digitata* to draw attention to the deeply excised distal margin of the scape which results in a thumb-like projection on the side opposite the pedicel attachment.

Melittobia femorata SP NOV

(Figs 43, 54, 64, 75, 90, 91, 107, 120, 132, 145, 156, 166, 179, 200, 201, 202, 225, 236)

TYPE MATERIAL:

Holotype ♂ 1 paratype ♀ mounted together 'Jackson and Franklin Counties, North Carolina, U.S.A., C.E. Hinton, 21.vi — 11.viii.1979, ex *Trypoxylon politum* '. (USNM); 44 paratype ♀♀ bearing the same data as holotype in the following institutions: BM(NH), QM, UCR, USNM; 4 ♀♀ 2 paratype ♂♂ on slides bearing the same data as holotype (QM).

DISTRIBUTION:

North Carolina, U.S.A.

DESCRIPTION:

Female: Critical point dried specimens 1.5–1.6 mm long. Head, antennal flagellum, mesosoma, coxae, trochanters dark brown; proximal 2/3 femora and metasoma paler brown; remainder of legs, dorsal scape and pedicel rufous brown; ventral scape and pedicel yellow-brown. Sculpture pattern on head relatively fine giving the surface a dull shagreened appearance as in *M. megachilis*.

Head in frontal aspect (Fig. 43) relatively narrow, length to genal width 1.3:1; genal-clypeal margin angled; clypeal margin (Fig. 64) bilobed, lobes broad; eyes relatively bare, with only a few short scattered setae. Facial grooves remaining separate to scrobes, maximum width between arms 1.2 times diameter of median ocellus; contracting gradually to meet scrobes below middle of eyes; minimum distance between arms 0.2 times diameter of median ocellus. Scrobe to eye length 1:2.7. Mandibles (Fig. 54); anterior tooth short, very broad, second and third well defined, broad, equal. Maxillary palps (Fig. 75) elongate, cylindrical, relatively long 4.2:1. Antennae (Figs 90, 91); scape narrow, L:W 3.7:1; MPS formula on flagellum 577:763; club segment 3 (Fig. 107) shortest length to width 1:1.8; nipple elongate, L:W 4:1; subterminal seta situated just below middle of nipple.

Mesosoma in dorsal aspect. Prothorax L:W 1:1.5. Posterior margin of mesoscutum mid lobe 1.3 times wider than anterior margin of scutellum. Scutellum mid lobe L:W 1.9:1; 1 pair of setae on each submedian lobe, posterior seta situated on posterior margin of lobe. Mesoscutum and scutellum mid lobe sculpture pattern (Fig. 145). Propodeum with posterior margin truncate emarginate, posterolateral angles 90°. Fore wing (Fig. 120) L:W 2.3:1; costal margin bent at junction with parastigmal vein; 3–5 setae on submarginal vein; marginal to submarginal vein length 1.3:1; stigmal vein (Fig. 132) in some specimens quite distinctive, in others it is not unlike that of *M. scapata* (Fig. 130); marginal to stigmal vein length 5.3:1; submarginal to stigmal vein length 4.0:1 ; terminal seta on end of postmarginal vein not longer than those on marginal vein.

Male: Critical point dried specimen 1.5 mm long. Head, body and legs rufous brown except for infuscations on distal scape, pedicel, vertex, mesosoma and metasoma.

Head in frontal aspect (Fig. 156) vertex broadly rounded, lateral margins flat, parallel, L:W 1:1; clypeal margin bilobed. Mandibles (Fig. 166); anterior tooth long, broad, widely separated from others; second and third teeth well defined, broad, equal. Maxillary palps (Fig. 179) elongate, cylindrical, L:W 4.8:1. Antennae (Figs 200–202); scape gradually expanded from proximal end, distal 1/3 showing a slightly greater expansion; length to head length 1:1.5, L:W 1.8:1; ventral surface with distal, deep, cup-shaped depression; glandular area transverse, broad, expanded at side opposite pedicel attachment; distal end of scape transverse, with a deep, relatively narrow excavation; 5 funicular segments, the first is one of the ring joints expanded and segment 2 is equivalent to segment 1 of other species; funicular segmental proportions 1 small, 2 largest, L:W 1:1.4, segments 3–5 sub-equal with 3 the smallest; width of segments 4–5 to length of segment 2 is 1:1.5; MPS formula on flagellum 00142:432.

Mesosoma in dorsal aspect. Prothorax L:W 1:1.4. Parapsidial sutures and axillae not as well defined as *M. clavicornis*. Scutellum without submedian grooves; sublateral grooves clearly marked; 2 pair of long setae situated as in female. Fore trochanters without a ventral tuft of short, stiff setae; fore tarsi with segments 3 + 4 fused. Mid legs (Fig. 225); trochanters with a ventral tuft of long, fine setae; femoral fringe uneven, proximal fringe about equal to width of femur and extends for approximately half the femur; distal fringe is dense with extremely long setae about 1.75 times width of femur; L:W femur 3.9:1; tibia L:W 3:1; mid tarsi without fused segments. Fore wings (Fig. 236) broad, L:W 2.6:1; marginal to submarginal vein length 1.3:1; costal cell narrow, L:W 7.6:1, costal margin above, straight; stigmal vein well developed.

MATERIAL EXAMINED:

The specimens listed in TYPE SPECIMENS section.

This species is named *femorata* to draw attention to the extremely long mid femoral setae of the male.

Melittobia chalybii Ashmead.

(Figs 44, 55, 65, 76, 92, 108, 121, 133, 146, 157, 167, 180, 203, 204 205, 226, 237)

Melittobia chalybii Ashmead, 1892 : 231.
Melittobia chalybii : Dalla Torre, 1898 : 85.
Melittobia chalybii : Schmiedeknecht, 1909 : 466.
Melittobia chalybii : Peck, 1951 : 452.
Melittobia chalybii : Burks, 1958 : 67.
Melittobia chalybii : Peck, 1963 : 162.
Melittobia chalybii : Gordh, 1979 : 1005.

TYPE MATERIAL:

Ashmead (1892) did not select a primary type and merely said, '... from many specimens of both sexes, reared September 14 from cells of *Chalybion caerubum* Linn. collected in Virginia'. I have selected a lectotype and paralectotypes from his point-mounted, syntypical series in the USNM as follows:

1 ♂ minus right antennae flagellum and left wings 'Bladensb. Va. Sept. 14.91', 'Paratype No. 2135 U.S.N.M.'. LECTOTYPE.

1 ♂ minus left antenna, right antennal flagellum and right wings 'Va.', '♂', 'Allotype No. 2135 U.S.N.M.', '*Melittobia chalybii* Ashm.'. PARALECTOTYPE.

1 ♂ minus both antennal flagella, all wings and part of left mesosoma 'Va.', '♂', 'Paratype No. 2135 U.S.N.M.'. PARALECTOTYPE.

1 ♀ intact 'Bladensb. Va. Sept.14.91', 'Paratype No. 2135 U.S.N.M.', '*Melittobia chalybii* Ashm.'. PARALECTOTYPE.

1 ♀ intact 'Va.', '♀', 'Paratype No. 2135'. PARALECTOTYPE.

1 ♀ minus right antennal flagellum and all wings 'Va.', '♀', 'Paratype No. 2135 U.S.N.M.'. PARALECTOTYPE.

In addition to the above there is 1 point bearing only some legs from a ♂ syntype labelled 'Va.', '♂', 'Paratype No. 2135 U.S.N.M.'. The USNM labels on these specimens incorrectly indicate that the series contains an allotype and several paratypes. Presumably the specimen with a USNM holotype label no longer exists.

DISTRIBUTION:

U.S.A. — Virginia and New Jersey.

DESCRIPTION:

Female: Air dried specimens 1.3–1.5 mm long. Head, antennal flagellum, mesosoma, coxae, proximal 2/3 femora dark brown; mesosoma paler; scape, pedicel, remainder of legs yellow brown.

Head in frontal aspect (Fig. 44) extremely setose, relatively broad, length to genal width 1.2:1; genal-clypeal margin broadly rounded; clypeal margin (Fig. 65) bilobed, lobes relatively small, each with a small, lateral, lobe-like undulation; eyes densely clothed in longish setae. Facial grooves remaining separate to scrobes; maximum distance between arms 1.2 times diameter of median ocellus; arms converge gradually to meet scrobes just below middle of eye; minimum distance between arms 0.2 times diameter of median ocellus. Scrobe to eye length 1:1.9. Mandibles (Fig. 55); anterior tooth relatively short, narrow; second and third well defined, 2 the narrowest. Maxillary palps (Fig. 76) elongate, cylindrical, of medium width, L:W 3.4:1. Antennae (Fig. 92); scape narrow, L:W 3.3:1; MPS formula on flagellum 346:663, club segment 3 (Fig. 108) shortest length to width 1:2.6; nipple elongate, L:W 3:1; subterminal seta just below middle of nipple. Mesosoma in dorsal aspect. Prothorax L:W 1:1.4. Posterior margin of mesoscutum mid lobe 1.5 times wider than anterior margin of scutellum mid lobe. Scutellum mid lobe L:W 1.9:1; submedian lobes each with 3–5 setae, sometimes varying between left and right on the same specimen. Mesoscutum and scutellum mid lobes sculpture pattern (Fig. 146). Propodeum posterior margin an open V-shape, posterolateral angles obtuse. Fore wing (Fig. 121) L:W 2.4:1; costal margin not as sharply bent at junction with parastigmal vein as other species (except *M. acasta*); marginal to submarginal vein length 1.5:1; 5–6 long setae on submarginal vein; stigmal vein (Fig. 133); marginal to stigmal vein length 4.6:1; submarginal to stigmal vein length 3.2:1; terminal seta on postmarginal vein as long as setae on marginal vein.

Male: Air dried specimens 1.1 mm long. Head, body, legs uniform golden brown. There are indications that the head may be paler than the rest and that the mesosoma is lightly infuscated, but confirmation requires fresh material.

Head in frontal aspect (Fig. 157) rather globose in slide-mounted specimens, L:W 1:1. In air dried specimens head folds transversely just below ocelli which gives the head a shape more like *M. acasta* (Fig. 152).

Genae contracted well below eye spots; clypeal margin bilobed. Mandibles (Fig. 167) elongate, anterior tooth long, narrow, not widely separated from second; second and third unequal, acute, 2 the longer. Maxillary palps (Fig. 180) elongate cylindrical, of medium length, L:W 3.3:1. Antennae (Figs. 203–205). Scape relatively broad, evenly expanded from proximal end, length to head length 1:1.5; L:W 1.6:1; ventral surface (Fig. 204) with a distal, deep, cup-shaped depression; glandular area geniculate; distal end of scape with a relatively shallow excavation, not as deep as in *M. digitata;* funicular segmental proportions 1 the largest, L:W 1:1.3; segments 2–4 sub-equal, 2 the smallest, width of 2–4 to length of 1 1:1.7; MPS formula on flagellum 021:242.

Mesosoma in dorsal aspect. Prothorax L:W 1:1.3. Parapsidial sutures and axillae not as well defined as in *M. clavicornis.* Scutellum without submedian grooves; sublateral grooves weakly defined; 2–3 pairs of large setae positioned as in female. Fore trochanters with a tuft of short, stiff setae, less dense, but longer than *M. australica;* fore tarsi with segments 3 + 4 fused. Mid legs (Fig. 226); trochanters with a ventral tuft of long, fine setae; femoral fringe uneven, proximal 1/3 shorter than width of femur, distal 2/3 approximately as long as width of femur; L:W femur 3.7:1; tibia L:W 3.4:1; mid tarsi without fused segments. Fore wing (Fig. 237) broad though relatively elongate, posterior margin relatively straight and parallel to costal margin, L:W 2.9:1; marginal to submarginal vein length 1.6:1; costal cell narrow, L:W 11.7:1, costal margin above not arched; stigmal vein well developed.

MATERIAL EXAMINED:

USNM 3 ♀ 3 ♂ syntypes as in TYPE SPECIMENS section. 2 ♀♀ 3 ♂♂ card-mounted 'Marlton, N.J., 3.17.40, vial 6, R.G. Schmieder'; 2 ♂♂ same data but from vial 5.

QM 3 ♀♀ 2 ♂♂ on a microscope slide, same data as above, vial 5.

Over the years the name *M. chalybii* has been applied to more than one species of *Melittobia* from North America. Buckell (1928) applied it to *M. digitata.* Although I have not examined his specimens his figures are quite clear and the scape of *M. digitata* males is very distinctive. However, the most common species confused with *M. chalybii* is *M. australica* from which it is easily distinguished using the following characters:

	chalybii	*australica*
Female:		
Scape L:W	3.1:1	2.5:1
Scape & pedicel	yellow brown	infuscated
Clypeal margin	bilobed	truncate
Facial grooves	converge separately to scrobes	converge to meet then pass to scrobes as a single line
Setae on submarginal vein	5–6	4
Setae on each submedian lobe of scutellum	3–4	2
Male:		
Scape	ventral cup	ventral groove
Segment 1 of flagellum	the largest	the smallest
Head shape	Fig. 174	Fig. 175
Clypeal margin	bilobed	without lobes
Mid-leg trochanters	with a dense tuft of long fine setae	without this tuft
Fore-wings L:W	2.9:1	3.7:1
Stigmal vein	well developed	reduced to a swelling on marginal vein

Although *M. chalybii* is the commonest name used in the literature for North American *Melittobia* it was the least common species encountered amongst collections borrowed for this revision or forwarded for identification. In fact the only specimens available were the types and some dried specimens from USNM.

Melittobia megachilis (Packard)

(Figs 45, 66, 77, 93, 109, 122, 134, 147)

Anthophorabia megachilis Packard, 1864 : 134.
Anthophorabia megachilis : Packard, 1868 : 204.
Anthophorabia megachilis : Packard, 1869 : 206.
Pteromalus gerardi Hickok, 1875 : 131.
Anthophorabia megachilis : Howard, 1885 : 46.
Melittobia megachilis : Cresson, 1887 : 244.
Melittobia megachilis : Ashmead, 1892 : 229.
Melittobia megachilis : Ashmead, 1894 : 26.
Melittobia megachilis : Dalle Torre, 1898 : 85.
Chrysocharis aeneus Brues, (1909) : 161.
Melittobia megachilis : Schmiedieknecht, 1909 : 466.
Miotropis megachilis : Viereck, 1916 : 465.
Chrysocharis aeneus : Girault, 1925 : 3.
Melittobia megachilis : Girault, 1925 : 3.
Melittobia megachilis : Peck, 1951 : 452.
Melittobia gerardi : Burks, 1958 : 67.
Melittobia megachilis : Burks, 1958 : 67.
Melittobia megachilis : Peck, 1963 : 162.
Melittobia megachilis : Gordh, 1979 : 1005.

TYPE SPECIMENS:

Packard's species is represented by a syntypical series of 5 females and a tube of dried larvae. These specimens reside in the collections of MCZ, Harvard. Two of the five females I recovered from amongst the dried larvae and mounted on one card with a paralectotype label. The three remaining females were mounted separately on points as follows:

1) A reasonably complete female minus right flagellum and labelled '*Anthophorabia megachilis* Pack. F.W.P.', 'Type 529'. I have removed one fore wing from this specimen and mounted it on a microscope slide.
2) A damaged female of which only wings and mesosoma remain mounted upside down in glue and labelled '*megachilis* ', 'Type 529''.
3) A female without wings labelled '*megachilis*', 'Type 529'. I have cleared and mounted this specimen on the slide with the wing of 1.

From these three I have selected (1) as the lectotype and (2–3) as paralectotypes. All specimens have been labelled accordingly.

I have not examined the types of *Pteromalus gerardi* Hickok and *Chrysocharis aeneus* Brues to confirm these synonymies.

DISTRIBUTION:

The type-locality is Brigport, Vermont, U.S.A.

DESCRIPTION:

Female: Air dried specimens 1.3 mm long; 2 ♀♀ ex larvae 1.5 mm long. Head, antennal flagellum, mesosoma, metasoma dark brown; coxae, femora lighter brown; scape, pedicel, remainder of legs yellow-brown. Sculpture pattern on head relatively fine giving the surface a dull shagreened appearance as in *M. femorata*.

Head in frontal aspect (Fig. 45) relatively narrow, length to genal width 1.4:1; genal margin relatively straight, more or less parallel; clypeal margin (Fig. 66) bilobed; eyes relatively bare, with a few, short, scattered setae. Facial grooves remaining separate to scrobes; greatest width between arms 1.8 times diameter of median ocellus; arms converging gradually to meet scrobes well below middle of eyes; minimum distance between arms 0.2 diameter of median ocellus. Scrobe to eye length 1:2.2 but may be larger because the eyes are folded transversely. Mandibles not visible. Maxillary palps (Fig. 77) elongate, cylindrical, long, L:W 5:1. Antennae (Fig. 93); scape narrow, L:W 3.7:1; MPS formula on flagellum 565:663; club segment 3 (Fig. 109) shortest length to width 1:1.4; nipple relatively short, L:W 2.5:1; subterminal seta almost basal.

Mesosoma in dorsal aspect. Prothorax L:W 1:1.4. Posterior margin of mesoscutum mid lobe 1.5 times wider than anterior margin of scutellum mid lobe. Scutellum mid lobe L:W 1.9:1; 1 pair of setae on each submedian lobe, posterior seta on posterior margin of lobe. Propodeum posterior margin an open V-shape, posterolateral angles obtuse. Mesoscutum and scutellum mid lobe sculpture pattern (Fig. 147). Fore wing (Fig. 122) L:W 2.5:1; marginal to submarginal vein 1.3:1; 4 setae on submarginal vein; marginal to stigmal vein length 5.2:1 ; submarginal to stigmal vein 4.0:1; terminal seta on postmarginal vein not longer than those on marginal vein.

Male: Unknown.

MATERIAL EXAMINED:

Only the types of this species were available as in the section TYPE SPECIMENS.

Melittobia australica Girault

(Figs 46, 56, 68, 78, 96, 97, 112, 124, 135, 148, 158, 169, 181, 206, 207, 208 227, 238)

Melittobia australica : Girault, 1912 : 203.
Melittobia australica : Girault, 1913 : 205, 250.
Melittobia australica : Girault, 1914 : 8.
Melittobia australica : Girault, 1915 : 216, 259.
Melittobia australica : Dahms, 1973 : 411.

TYPE SPECIMENS:

The syntypical series of Girault consists of 7 ♀♀ 2 ♂♂ on a microscope slide '*Melittobia australica* 2 ♀ 2 ♂', 'TYPE Hy/997, A. A. Girault' (QM). There are in DPIQ 5 slides containing numerous specimens of both sexes and all labelled, 'Dep. Ag. & Stk., Qld. CHALCIDIDAE *Melittobia australica* Ex *Pison spinolae* (Hym.) Tambourine 11/12/11 H.T. No. Hy.58', 'Mt. Tambourine S. Queensland Dep. Ag. & S. 11.12.11'. These are all part of the original series bred by Tryon, but have no Girault labels. One of these slides contains 3 females and 1 male therefore fitting Girault's published information for his 'Cotypes' and it would be safe to assume that he saw the remainder of the slides. I am therefore labelling the 5 slides as containing paralectotypes. The QM slide has been relabelled by someone other than Girault and the error in the number of females (2 as opposed to 7) is no doubt one of transliteration. From this scries I have selected the intact male as the lectotype and the remaining specimens (7 ♀♀ 1 ♂) as paralectotypes. No locality data occurs on this slide, but the published data read, 'Host, *Pison spinolae* (Hym.) Mt. Tambourine, S. Queensland, Dept. Ag. & S., 11; 12; 11'.

DISTRIBUTION:

South Africa, Australia, Japan (= species 2 of van den Assem and Maeta (1978)), North America (= *M. chalybii* of Hermann(1971), Evans and Matthews (1976)), Jamaica (= *M. chalybii* of Freemann and Parnell (1973), Freemann (1977)) (= *hawaiiensis* complex of Freeman and Ittyeipe (1976), Jayasingh and Freeman (1980)), (= species 8 of van den Assem, Bosch and Prooy (1982)).

DESCRIPTION:

Female: Critical point dried specimens 1.1–1.2 mm long. Head, antennal flagellum, mesosoma, coxae, proximal 2/3 femora dark brown; scape and pedicel barely paler; metasoma paler; remainder of legs pale brown.

Head in frontal aspect (Fig. 46) length to genal width 1.4:1; genal-clypeal margin broadly rounded; clypeal margin (Fig. 68) truncate emarginate; eyes densely covered with long setae. Facial grooves converging to meet just above middle of eyes then passing as a single line to scrobes; maximum width between arms 2.9 times diameter of median ocellus (approximately equals POL). Scrobe to eye length 1:2.8. Mandibles (Fig. 56); anterior tooth long, narrow relatively close to second; second and third tooth well defined, 2 longer and narrower. Maxillary palps (Fig. 78) cylindrical, short, L:W 2.8:1. Antennae (Figs 96, 97); scape broad, L:W 2.5:1; MPS formula on flagellum 445:573; club segment 3 (Fig. 112) shortest length to width 1:1.2; nipple elongate, L:W 4:1; subterminal seta in distal half of nipple.

Mesosoma in dorsal aspect. Prothorax L:W 1:1.5. Posterior margin of mesoscutum mid lobe 1.3 times wider than anterior margin of scutellum mid lobe. Scutellum mid lobe L:W 1.9:1. Mesoscutum and scutellum mid lobe sculpture pattern (Fig. 148). Submedian lobes of scutellum each with 1 pair of setae, posterior seta well forward of posterior margin of lobe. Propodeum posterior margin an open V-shape, posterolateral angles obtuse. Fore wing (Fig. 124) L:W 2.3:1; marginal to submarginal vein length 1.6:1; 4 setae on submarginal vein; stigmal vein (Fig. 135); marginal to stigmal vein length 4.2:1; submarginal to stigmal vein length 2.6:1; terminal seta on postmarginal vein slightly longer than those on marginal vein.

Male: Critical point dried specimens 1.2–1.3 mm long. Entirely honey brown in colour except upper face in an area equivalent to that between the facial grooves in female pale, mesoscutum lightly infuscated, funicle segment 4 plus club strongly infuscated.

Head in frontal aspect (Fig. 158) wider than long L:W 1:1.4, transversely elliptical, lateral margins broadly rounded; clypeus deeply impressed, area above impressed clypeus and below toruli with a dense tuft of fine setae (similar to head setation); clypeal margin without lobes, as Fig. 158. Mandibles (Fig. 169); anterior tooth relatively broad and widely separated from second; second and

third well defined, sub-equal, 2 slightly longer. Maxillary palps (Fig. 181) as *M. hawaiiensis,* cylindrical, short and broad, L:W 2.5:1. Antennae (Figs 206–208); scape broad, expanded evenly from proximal end except for a pronounced constriction about mid-way along scape; length to head length 1:1; scape L:W 1.8:1; ventral surface (Fig. 207) with a deep longitudinal groove, proximal end of groove with only one seta; glandular area geniculate, one arm more or less transversely across distal scape, the other along the side of groove opposite pedicel attachment; flange overhanging scape groove on same side as pedicel attachment with up to 5 setae, most of which are not on the margin; distal scape margin more or less transverse, not oblique; funicular segmental proportions (Fig. 208) 1 short the smallest segment; 2 and 3 large, wider than long; 4 short, transverse, cup-shaped, closely applied to club segment 1; MPS formula on flagellum 0000:141.
Mesosoma in dorsal aspect. Prothorax 1:1.5. Parapsidial sutures and axillae reasonably well defined though not as well as in *M. clavicornis.* Submedian grooves of scutellum absent, sublateral grooves faint; 2 pair of setae present, positioned as in female. Fore legs with a dense tuft of short, stiff setae (Dahms 1983b: Plate 4b); tarsal segments 3 + 4 fused. Mid leg (Fig. 227) trochanters without a ventral, dense tuft of long, fine setae; femoral fringe divided into 2 sections, a short proximal tuft on basal 1/4 of femora, a space without setae about equal to 1/4 femoral length followed by a fringe occupying distal 1/2 of femur; setal fringe slightly longer than 1.5 times width of femur; L:W femur 4.3:1; tibia L:W 4.1:1; tarsi without fused segments. Fore wings (Fig. 238) elongate, apex rounded, L:W 3.7:1; marginal to submarginal vein length 1.9:1; stigmal vein reduced to a swelling on end of marginal vein; costal cell narrow L:W 13.5:1; costal margin slightly arched above.

MATERIAL EXAMINED:

QM Lectotype and paralectotypes as in TYPE SPECIMENS section; 6 ♀♀ 4 ♂♂ card-mounted 'Brisbane SEQ, E.C. Dahms, Dec. 1979, ex *Sceliphron laetum* '; 2 ♀♀ 2 ♂♂ slide-mounted '*Melittobia australica* Grlt. E. Dahms det. 1980, Brisbane, SEQ, E.C. Dahms, Dec. 1979 ex *Sceliphron laetum,* Euparal E.C.D.'; 27 ♀♀ slide-mounted '*Melittobia australica* Girault, Bred from cells of *Sceliphron laetum,* 20.1.1918, H. Hacker'; 16 ♀♀ 4 ♂♂ second-form individuals 'Brisbane, January 1981, E.C. Dahms ex laboratory colony on *Sceliphron formosum* '; 17 ♀♀ 4 ♂♂ card-mounted 'Acacia Ridge, Brisbane, SEQ, E. Dahms, 21.1.1979', 'ex *Stenarella victoriae* '; 2 ♀♀ 2 ♂♂ card-mounted, 4 ♀♀ 5 ♂♂ slide-mounted 'Arita-gun, Wakayama Pref., Japan, on *Megachile subalbuta,* M. Matsuura, iii.1976'; 8 ♀♀ 2 ♂♂ card-mounted, 4 ♀♀ 2 ♂♂ slide-mounted 'Kingston, Jamaica, West Indies, on *Sceliphron assimili,* K. Ittyeipe, v.1975'; 8 ♀♀ 2 ♂♂ card-mounted, 3 ♀♀ 3 ♂♂ slide-mounted 'ex culture maintained at University of Georgia, D.A. Evans, on *Trypoxylon striatum,* v.1975'; 2 ♀♀ 2 ♂♂ on a microscope slide 'Brits., Transvaal, Rep. South Africa on *Sceliphron* sp., R.T. Simon Thomas, xi.1974'.

In addition 4 ♀♀ and 1 ♂ from the following localities are deposited in BM(NH) and USNM.

1) 'Brisbane, SEQ, E.C. Dahms, Dec. 1980, ex *Sceliphron laetum* '.
2) 'Brisbane, SEQ, E.C. Dahms, January 1981', 'ex laboratory colony on *Sceliphron formosum,* second-forms'.

Melittobia hawaiiensis Perkins

(Figs 94, 95, 110, 111, 123, 136, 168, 170, 209, 210)

Melittobia hawaiiensis : Swezey, 1907 : 125.
Melittobia hawaiiensis Perkins, 1907 : 126.
Melittobia hawaiiensis peles Perkins, 1907 : 127.
Sphecophagus sceliphronidis Brèthes, 1911 : 209.
Sphecophilus sceliphronidis : Brèthes, 1911 : 311 SYN NOV
Melittobia hawaiiensis : Masi, 1917 : 226.
Melittobia hawaiiensis : Ferrière, 1933 : 103.
Melittobia hawaiiensis : Gradwell, 1958 : 277.
Melittobia peles : Yoshimoto, 1965 : 683.
Melittobia hawaiiensis : Yoshimoto, 1965 : 683.
Melittobia hawaiiensis : De Santis, 1973 : 18.

TYPE SPECIMENS:

Perkins (1907) did not indicate the location of the type of this species and did not consider it necessary ... 'because the specimens could not be preserved in satisfactory condition for subsequent comparison'. Gradwell (1958) selected a neotype

of this species from a slide containing 11 ♀♀ 1 ♂ in the collections of the British Museum (Nat. Hist.). I have examined this slide and confirmed the separation of *M. hawaiiensis* and *M. australica.* The separation is not easy, but it was aided by fresher material of *M. hawaiiensis* and *M. australica* , in conjunction with the fact that the two will not interbrced (van den Assem pers. comms. 1974–1980). Brèthes (1911) described the species *Sphecophagus sceliphronidis* and in 1911 changed the generic name to *Sphechophilus* believing *Sphecophagus* to bc preoccupied. De Santis (1949) transferred this species to the genus *Melittobia.* In 1957 De Santis made *S. sceliphronidis* a junior synonym of *M. acasta.* I have been unable to locate the type of *S. sceliphronidis,* but from Brèthes' figures and description, the species is definitely not *M. acasta* — the scape has a ventral longitudinal groove. The only species it could possibly be, given the present state of knowledge of the world *Melittobia* fauna, are *M. hawaiiensis, M. australica* or sp. nov. Argentina. From Brèthes' figures it is clearly not the latter. De Santis (1973) records *M. hawaiiensis* from Argentina but this species is difficult to separate from *M. australica* without slide preparations of the male scape. In the absence of any material of these species from South America and the type of *S. sceliphronidis* I have provisionally placed *M. sceliphronidis* as a junior synonym of *M. hawaiiensis* subject to confirmation.

DISTRIBUTION:

South America, Hawaii, New Zealand (= *M. clavicornis* Donovan (1953) and Cowley (1961)) (= species 7 of van den Assem, Bosch and Prooy (1982)), Scychelles, Guam. In the literature there are a great many localities given for this species especially around the Pacific region, e.g. Yoshimoto (1965). Because of the ease of confusion of this species with *M. australica* I have listed only the distribution of specimens I have examined.

DESCRIPTION:

Female: In all aspects examined the females of *M. hawaiiensis* and *M. australica* tend to grade into one another e.g. variations in shape of the stigmal vein overlap, the degree of infuscation of the scape and pedicel is variable within each species and overlaps between species and so on. Given the present state of knowledge of the two species I cannot separate them on females.

Male: Again *M. hawaiiensis* and *M. australica* males are very similar in most respects and their variations overlap between species. Only one consistent feature serves to distinguish the species and that is setation on the scape. Compare figures 206, 209 and 210. The flange overhanging the groove of the scape, on the same side as the pedicel is attached, is relatively longer, and has more than 5 setae, most of which are arranged on the edge of the flange; the proximal floor of the groove has more than 2 setae (generally 5 or more) as opposed to 1–2 in *M. australica.* The last mentioned setal arrangement appears very reliable in all specimens of the species that I have examined.

In addition to these species I have specimens of an *hawaiiensis* -type species from Kauai, Hawaii (= species 7/8 of van den Assem et alia (1982)). Again the females appear very similar to *M. hawaiiensis* and *M. australica* except that the nipple on club segment 3 is longer and narrower (Figs 110–112). Males also are very similar except in the setation patterns on the scapes. The flange overhanging the scape groove is relatively short as in *M. australica,* it has more setae than in *M. hawaiiensis* and these setae are distributed along the entire length of the flange, whereas they are more restricted in *M. australica* and *M. hawaiiensis.* The mandiblcs of males also show some differences (Figs 168–170). However I am rather hesitant to describe the Kauai material as a new species. This whole complex is in need of a detailed morphometric study which could be tied in with ethological work of van den Assem et alia (1982). In the summary of this paper aspects of crossing experiments by van den Assem et alia (1982) with *hawaiiensis* group species and Kauai are discussed.

MATERIAL EXAMINED:

BM(NH) Neotype slide with 11 ♀♀ 1 ♂ as figured by Gradwell (1958).
1 ♀ card-mounted 'Mahé '08–9, Seychelles Exp.', 'Percy Sladen Trust Exped., BM 1913–170', '*Melittobia hawaiiensis* Perkins, L. Masi det.'

QM 7 ♀♀ 1 ♂ on a microscope slide '*Melittobia hawaiiensis* Perk., Gahan, ex *Pison argentatum,* Piti, Guam 9-27-36, O.H.S.'; 3 ♀♀ 3 ♂♂ on microscope slides, 4 ♀♀ 2 ♂♂ card-mounted '*Melittobia hawaiiensis* Perkins, ex Lab culture Est. from Te Pirita, Cantebury, New Zealand, Sept. 1974, B.J. Donovan ex *Pison spinolae,* E.C. Dahms

Euparal'; 6 ♀♀ 3 ♂♂ on microscope slides, 1 ♀ 1 ♂ card mounted 'ex lab culture est. from Kilauea, Kauai, Hawaii, 21.xi.1976, S.L. Montgomery and J. Maciolek 100' ex mud nest, E.C. Dahms Euparal'.

Melittobia assemi SP NOV

(Figs 67, 79, 125, 137, 149, 159, 171, 182, 211, 212, 213, 228)

TYPE SPECIMENS:

Holotype ♂ 5 ♀ paratypes on the one card 'Anse Bazarca, Mahé Island, Seychelles, ex eumenid species, R.T. Simon Thomas, ii.1976' BM(NH); 2 ♀ paratypes card-mounted, 4 ♀ 2 ♂ paratypes on a slide with data as holotype (QM).

DISTRIBUTION:

Mahé Island, Seychelles (*M. hawaiensis* (in part) of Masi (1917)), Kerala Forest Reserve, India (= species 5 of Assem, Bosh and Prooy (1982))

DESCRIPTION:

Female: Critical point dried specimens 1.3 mm long. Head, flagellum, mesosoma, coxae dark brown; proximal 2/3 femora, metasoma slightly paler; scape, pedicel, remainder of legs pale yellow-brown; upper scape and pedicel lightly infuscated.

Head in frontal aspect as *M. sosui* (Fig. 47) length to genal width 1.3:1; genal-clypeal margin broadly rounded; clypeal margin (Fig. 67) bilobed, lobes small, each sharply separated from a small, lateral, lobe-like undulation. Eyes densely clothed with long setae. Facial grooves converging to meet just above middle of eyes then passing as a single line to scrobes; maximum distance apart of arms greater than POL. Scrobe to eye length 2.6:1. Mandibles as *M. sosui* (Fig. 57) anterior tooth very small, broad; second and third well defined, broad, 3 the broadest. Maxillary palp (Fig. 79) short, broad, L:W 2.5:1. Antennae as *M. sosui* (Figs 100, 101) scape broad, relatively strongly curved, L:W 2.8:1; MPS formula on flagellum 335:263; segment 3 of club as *M. sosui* (Fig. 113) shortest length to width 1:2; nipple relatively long, L:W 3:1; subterminal seta about mid-way down nipple.

Mesosoma in dorsal aspect. Prothorax L:W 1:1.5. Posterior margin of mesoscutum mid lobe 1.1 times wider than anterior margin of scutellum mid lobe. Scutellum mid lobe L:W 1.9:1; 3–4 setae on each sublateral lobe. Propodeum posterior margin an open V-shape, posterolateral angles obtuse. Fore wing (Fig. 125) L:W 2.4:1; marginal to submarginal vein length 1.5:1; 5 setae on submarginal vein, the proximal 2 about 1/2 length of others; stigmal vein (Fig. 137); marginal to stigmal vein length 3.4:1; submarginal to stigmal vein 3.7:1.

Male: Air dried ex alcohol about 1.3 mm long. Head, body and legs pale golden brown; antennae also, except funicle 4 and club which are infuscated.

Head in frontal aspect (Fig. 159) broad, vertex broadly rounded, hardly raised, lateral margins broadly rounded contracting slowly below eye spots; genal-clypeal margin broadly rounded; clypeal margin bilobed, lobes long, narrow, clypeus deeply excised between; clypeus deeply impressed, area above impression and below toruli with a dense cluster of long, fine setae. Mandibles (Fig. 171) broad, anterior tooth of medium length, broad, well separated from second; second and third tooth shallowly defined, broad. Maxillary palps (Fig. 182) tapered distally, short, broad, L:W 2.2:1. Antennae (Figs 211–213); scape more or less gradually expanded from proximal end, whole scape curved, concave on outer margin; ventral surface with a deep, longitudinal groove, more open than *M. australica* (Fig. 206), flange over-hanging groove on side of pedicel attachment narrow, without long setae; glandular area geniculate, but distal arm not as transverse as in *M. australica* (Fig. 207); distal scape transverse, not excavated (Figs 211–212); scape length to head length 1.3:1; scape L:W 1.6:1; pedicel tends to be concave on inner margin as in *M. sosui* (Fig. 216); funicular segmental proportions (Fig. 213) 1–3 sub-equal, 4 transverse, cup-shaped, closely applied to segment 1 of club; MPS formula on flagellum 0000:162.

Mesosoma in dorsal aspect. Prothorax L:W 1:1.3. Parapsidial sutures absent, axillae poorly defined. Scutellum without submedian or sublateral grooves; 3–4 pairs of setae on scutellum positioned as in females. Fore trochanters without a ventral, dense tuft of stiff, short setae; tarsi (Fig. 20) with 2 segments, 2 + 3 + 4 fused. Mid legs (Fig. 228); trochanters with 6–12 long, curved, stiff setae; femoral fringe of uneven length,

sparse, proximally absent, followed by a few short setae, then a median fringe of setae not quite long as width of femur, the distal c. 1/4 of fringe consists of short setae, width of femur to length of distal fringe is about 2.5:1; L:W femur 3.6:1; tibia L:W 3.7:1; mid tarsi with 3 segments, segments 1 and 2 with a posterior comb of long thick setae. Fore wing as *M. sosui* (Fig. 239) long, narrow, L:W 4.1:1, apex acute; marginal to submarginal vein length 1.7:1; costal cell narrow, L:W 6:1; stigmal vein reduced to a large swelling at the end of marginal vein.

MATERIAL EXAMINED:

Type specimens as in TYPE SPECIMENS section.

QM 1 ♀ 1 ♂ + 1 ♂ head on microscope slides 'Nilambur Kerala State, South India, from H. van den Assem, Feb. 1980, E.C. Dahms Euparal'.

BM(NH) 4 ♀♀ card-mounted 'Percy Sladen Trust expedition, BM 1913-170', 'Mahé '08-9, Seychelles Exp.', '*Melittobia hawaiiensis* Perkins, L. Masi det.'.

This species has been named in recognition of Dr van den Assem, Leiden who has been very generous with notes from his ethological studies and with specimens.

Melittobia sosui SP NOV

(Figs 47, 57, 80, 100, 101, 113, 138, 172, 183, 214, 215, 216, 230, 239, 240)

TYPE MATERIAL:

Holotype ♂ 5 ♀ paratypes (one ♀ minus head) card-mounted 'Sosu, Okinawa Isl., Ryuku Arch., Japan, Y. Maeta, 23.xii.1978 ex Eumenid' (KU); 3 ♀ 2 ♂ paratypes on slides with data of holotype (QM).

DISTRIBUTION:

Okinawa Isl., Japan (= species 4 of van den Assem and Maeta (1980)) (= species 6 of van den Assem et alia (1982)).

DESCRIPTION:

This species is very close to *M. assemi* and the description to follow merely consists of diagnostic differences from *M. assemi.*

Female: Critical point dried specimens 1.3-1.4 mm long. Coloration as in *M. assemi.*

There are some proportional differences between *M. assemi* and *M. sosui* females, but these are not very significant given the natural variation in *Melittobia* and the polymorphism in the type-forms of *M. sosui* recorded by van den Assem and Maeta (1980). Therefore it would be unwise to rely upon these proportional differences for species separation. As with the *M. hawaiiensis* complex this species group is in need of detailed morphometric analysis.

In females that I have for examination there appear to be three consistent features which are of use:

1) Of the 5 setae on the submarginal vein in *M. assemi* the proximal 2 are about 1/2 the length of the remaining 3 whereas in *M. sosui* the 5 are of equal length.

2) On each submedian lobe of the scutellum, *M. assemi* has 3-4 setae, occasionally with variation between left and right on the one specimen, whereas in *M. sosui* I observed a consistent 2 on the left lobe and 3 on the right.

3) Stigmal veins are different (Figs 137, 138).

Males of the two species are also very similar but there are a few consistently different features:

1) The mandibles of *M. sosui* (Fig. 172) are shorter and broader than *M. assemi* (Fig. 171).

2) The maxillary palps in *M. sosui* (Fig. 183) are shorter than in *M. assemi* (Fig. 182); L:W 1.4:1 as opposed to 2.2:1 for *M. assemi.*

3) The scape of *M. sosui* (Figs 214, 215) is narrower than *M. assemi* (Figs 211, 212); L:W 2:1 as opposed to 1.6:1 for *M. assemi.* In *M. sosui* the flange overhanging the scape groove is broader than in *M. assemi* and bears several long setae (up to 5).

4) The mid femoral fringe has more setae and covers a greater length of the femur in *M. sosui* than in *M. assemi* (Figs 228, 230). The shapes of the femora are different; L:W *M. sosui* 3.8:1, *M. assemi* 3.6:1.

MATERIAL EXAMINED:

As in TYPE SPECIMENS section.

This species is named *M. sosui* after its type-locality.

Melittobia bekiliensis Risbec.

Melittobia bekiliensis Risbec, 1952 : 253.

TYPE MATERIAL:

2 ♀♀ 1 ♂ on minutien pins 'MADAGASCAR, Bekily, REG SUD DE L'ILE', 'MUSEUM PARIS, vi.36, A. SEYRIC', '*Melittobia bekiliensis* Risb', 'Syntype'. From this syntypical series I have selected the male as the lectotype and the females as paralectotypes. They reside in the collections of the Musée National d'Histoire Naturelle, Paris.

DISTRIBUTION:

Madagascar.

DESCRIPTION:

Female: Air dried specimens 1.0–1.1 long. Head, pedicel, flagellum, mesosoma dark brown; metasoma slightly paler; scape, legs pale yellow-brown.

These specimens appear to be very similar to females of *M. assemi.* It is difficult to separate them without making slides. This difficulty is increased due to disruption of the thorax by the minutien pin and reliable diagnosis of the female must await fresh material.

Male: Air dried specimen. About 1.2 mm long, specimen curled.

Head in frontal aspect resembling that of *M. assemi* (Fig. 159); not contracting ventrally as strongly as *M. assemi* and the clypeal region is barely impressed; setation below toruli not dense as in *M. assemi;* clypeal margin bilobed, lobes not as long as *M. assemi.* Mandibles not projecting below clypeal margin when closed. Maxillary palps contracting distally as *M. assemi* (Fig. 182). Antennal scapes quite distinctive, expanding evenly from proximal end (no constrictions as in *M. australica* (Fig. 207)), pyriform, not curved as in *assemi* (Fig. 212), dorsal surface smoothly rounded; ventral surface with a deep longitudinal groove, relatively open as in *M. assemi;* flagellum difficult to see; segment 1 very small; 2+3 slightly larger; 4 very wide, asymmetrically cup-shaped, closely applied to club, longest side of 4 nearly covering club segment 1.

Mesosoma in dorsal view. Prothorax wide, triangular, L:W 1:3. Fore legs as in *M. assemi* (Fig. 20). Fore trochanters without a ventral tuft of short, stiff setae; fore tarsi 2 segmented. Mid legs as *M. assemi* except distal setae on femoral fringe are not shorter than those of medial fringe; tarsal segments appear unfused. Fore wings resemble those of SP NOV Argentina (Fig. 241), apex broadly rounded; stigmal vein well developed.

This is quite a distinctive species in the male. Its scape, maxillary palp and femoral fringe place it with *M. assemi* and *M. sosui.*

Argentina SP NOV

(Figs 48, 58, 69, 81, 98, 99, 114, 126, 139, 150, 160, 173, 184, 217, 218, 219, 229, 241)

TYPE SPECIMENS:

Material too poor for type selection.

DISTRIBUTION:

Argentina.

DESCRIPTION:

Female: Air dried specimens from alcohol 1.1 mm long. Head, mesosoma, antennal flagellum, coxae, proximal 1/3 of femora dark brown; scape, pedicel and remainder of legs yellow-brown; metasoma slightly paler than mesosoma.

Head in frontal aspect (Fig. 48) broad, length to genal width 1.2:1; genal-clypeal margin broadly rounded; clypeal margin (Fig. 69) bilobed, lobes broad, weakly developed; eyes densely covered with long setae. Facial grooves converging separately to scrobes; maximum width between arms 2 times diameter of median ocellus; arms converging gradually to meet scrobes just below middle of eyes; minimum distance between arms 0.25 times diameter of median ocellus. Scrobe to eye length 1:1.9. Mandibles (Fig. 58); anterior and median tooth long, narrow, third shorter and broader. Maxillary palp (Fig. 81) elongate, of medium length, L:W 4:1. Antennae (Figs 98, 99); scape broad, L:W 2.5:1; MPS formula on flagellum 445:463; club segment 3 (Fig. 114) shortest length to width 1:2; nipple relatively long, L:W 3:1; 2 subterminal setae situated in proximal 1/3 of nipple.

Mesosoma in dorsal aspect. Prothorax L:W 1:1.8. Posterior margin of mesoscutum mid lobe equal to width of anterior margin of scutellum mid lobe. Scutellum mid lobe L:W 1.8:1; 1 pair of setae on each submedian lobe, posterior situated on posterior margin of this lobe. Mesoscutum and scutellum mid lobes sculpture pattern (Fig. 150). Fore wing (Fig. 126) L:W 2.2:1; marginal to submarginal vein

length 1.6:1; 4–5 setae on submarginal vein; stigmal vein (Fig. 139); marginal to stigmal vein length 4.8:1; submarginal to stigmal vein length 3.1:1; terminal seta on postmarginal vein no longer than those on the marginal vein.

Male: Air dried specimen from alcohol, metasoma absent, length of head mesosoma 0.5 mm. Head, scape, funicular segments 2–3, legs pale brown; funicular segment 4 club strongly infuscated.

Head in frontal aspect (Fig. 160) broad, more or less rectangular, lateral margins not contracting strongly to clypeus, genae slightly indented below eye spots, L:W almost 1:1; clypeus impressed, area above clypeus and below toruli with a dense tuft of long, thick setae; clypeal margin bilobed, lobes broad, well defined. Mandibles (Fig. 173) very broad, projecting well below clypeus when closed. Maxillary palps (Fig. 184) very distinctive, broad, distally excavated, L:W 1.4:1. Antennae (Figs 217–219); scape relatively evenly expanded from proximal end, distal 1/2 expanding rather suddenly; ventral surface (Fig. 218) with a deep longitudinal groove, more open than *M. australica;* glandular area rather amorphous, extending along groove; scape to head length 1:1.2; scape L:W 1.9:1; distal scape more or less truncate, without an excavation; funicular segments (Fig. 219) transverse, 1 the narrowest; 2 + 3 sub-equal; 4 as wide as 2 and 3, cup-shaped, closely applied to club segment 1; MPS formula on flagellum 0000:131.

Mesosoma in dorsal aspect. Prothorax L:W 1:1.6. Parapsidial sutures and axillae poorly defined. Scutellum without submedian and sublateral grooves. Fore legs (Fig. 21); trochanters without a dense tuft of short, stout setae; tarsal segments fused into 1. Mid legs (Fig. 229); trochanters with a few, curved, short, thick setae; femoral fringe not completely lining femora, basal 1/4 with very short, normal setation, distal 3/4 of even length, slightly longer than width of femur; ventral surface of femur appears grooved to receive tibia; L:W femur 7.2:1; tibia L:W 5.7:1; mid tarsi of 2 segments, 2 + 3 + 4 fused. Fore wing (Fig. 241) relatively broad, L:W 3:1; marginal to submarginal vein length 1.8:1; costal cell narrow L:W 6:1, costal margin above slightly arched; stigmal vein well developed.

MATERIAL EXAMINED:

CU,NY ♀♀fragments card mounted as follows — 3 heads with antennae; 2 heads plus mesosoma and 1 fore wing; 1 complete specimen except for antennae. 1 ♂ head plus mesosoma without wings; several fragmentary females in alcohol 'Ascasubi Argentina, Dec. 1976, R.H. Gonzalez', 'ex *Megachile rotundata* '; 3 ♀♀ 1 ♂ on a microscope slide with above data.

I have not named this species because the specimens are too poor for type-selection.

INCERTAE SEDIS

Melittobia osmiae Thompson

Melittobia osmiae Thompson, 1878 : 204.
Melittobia acasta (?) : Domenichini, 1966 : 56.

TYPE SPECIMENS:

Not located.

DISTRIBUTION:

Europe.

Domenichini (1966) provisionally placed this species as a junior synonym of *M. acasta.* It may well fit here, but the description is not diagnostic and I could not locate the type. For these reasons it was decided to leave it as a separate species awaiting confirmation.

Melittobia hawaiiensis peles Perkins

Melittobia hawaiiensis peles Perkins, 1907 : 125.
Melittobia peles : Yoshimoto, 1965 : 683.

TYPE SPECIMENS:

Not located.

DISTRIBUTION:

Oahu, Hawaii.

I have been unable to locate the type of this variety and the brief description by Perkins is insufficient to allow recognition of this taxon.

SUMMARY:

Van den Assem and Maeta (1978, 1980) using ethological criteria have divided the genus into *acasta* group, *hawaiiensis* group and Mahé group (= *assemi* group) and have kept *M. clavicornis* separate as the most primitive species. When one looks at the comparative morphology of the males a similar grouping applies using the following characteristics:

	acasta	*hawaiiensis*	*assemi*
1) scape:	cup	grooved	grooved
2) gland in scape:	transverse	geniculate	geniculate
3) proportions of funicular segments:	1 largest	1 smallest	all equal
4) funicular seg. 4 cup shaped and closely applied to club 1:	–	+	+
5) presence of plate organs on funicle:	+	–	–
6) mid trochanters with a dense tuft of long fine setae:	+	–	–
7) wings broad:	+	–	–

The grouping on this basis is as follows:

acasta group	*hawaiiensis* group	*assemi* group
acasta	*hawaiiensis*	*assemi*
evansi	*australica*	*sosui*
scapata	Kauai	*bekiliensis*
femorata		Argentina
digitata		
chalybii		
megachilis (?)		

Of these groups, *hawaiiensis* and *assemi* appear closest. I regard the unifying characters as derived relative to *M. clavicornis* and considering the shared possession of these derived characters, these two groups could confidently be regarded as monophyletic sister groups. Species within these groups can be sorted on a mixture of derived and relatively primitive features, and this again points to the monophyly of each group. The division is as follows:

	hawaiiensis group	*assemi* group
1) head	elliptical *	rectangular *
2) mandibles	narrow	broad *
3) funicle segments	1 small 2+3 large *	1–3 sub-equal *
4) mid femoral fringe	long proximally *	short proximally
5) fore trochanters with a dense tuft of short setae	+*	–
6) mid trochanters with 6–12 long, stiff curved seta	no long setae *	+ *
7) ventral fore trochanters with a dense setae tuft of stiff setae	+*	–

(* = characters I regard as derived)

The *hawaiiensis* group has relatively few species which may be a reflection of our state of knowledge of the world fauna. The species *M. hawaiiensis* and *M. australica* is very close morphologically and ethologically, but van den Assem et alia (1982) found that they are reproductively isolated when they tried crossing them. However, they discovered that females of both *M. hawaiiensis* and *M. australica* when crossed with males of Kauai produced fertile female offspring. Reciprocal crosses gave similar results. It appears therefore that male courtship in *M. hawaiiensis* and *M. australica* is not the same, but there are elements of Kauai male courtship which make them reproductively compatable with either *M. australica* and *M. hawaiiensis* and vice versa. This is a rather interesting situation since both *M. hawaiiensis* and Kauai occur on the islands of Hawaii and given the capability of *Melittobia* to be wind dispersed it is hard to imagine that geographical barriers operate. Given the highly polyphagous nature of *Melittobia* one can argue against ecological isolation. It appears therefore that the

hawaiiensis group is a relatively young group in the process of speciation. In contrast the *assemi* group contains more species showing greater morphological diversity. The comparative ethology of *M. assemi* and *M. sosui* only, is known for this group. These two species are very close morphologically and ethologically, (van den Assem and Maeta 1980), which indicates a fairly recent separation. *M. bekiliensis* is close to *M. assemi* on the basis of head and palp shape but its scape and funicle shape I regard as more derived. Sp. nov. Argentina is the most derived species on the basis of mandible and palp shape. The greater number of species in the *assemi* group and their greater morphological diversity suggests that this group is relatively older than the *hawaiiensis* group.

The *acasta* group, however, is less easy to divide phylogenetically. The relatively larger number of species in this group and their morphological and ethological diversity suggests an earlier origin for this group. The characters used for grouping the species are relatively primitive ones (many are shared with *M. clavicornis*) and therefore the group may be paraphyletic rather than monophyletic. Male morphological differences are closely related to the use of appendages and body parts during courtship. Without this knowledge it is difficult to place characters which separate species into a phylogenetic order with any confidence.

Two species, *M. acasta* and *M. digitata* can be grouped on their oblique distal scape, the excavation of this margin and the transverse, narrow shape of the scape gland. I regard *M. digitata* as the most derived and van den Assem (pers. comms. 1974–1980) regards it to be derived on ethological data also. The reduction in relative size of funicle segment 1 and the size of the scape I regard as derived and unify *M. evansi* and *M. scapata*. Two species, *M. femorata* and *M. chalybii* both possess an extra funicle segment as a result of expansion of one of the ring segment lamellae. Their scape shapes are more similar to one another than to any other species. Figs 203, 204 of *M. chalybii* were from a slide in which the scapes are slightly rolled. In dry specimens the excavation of the scape in *M. chalybii* is of the *M. femorata* type but not so deep. I regard *M. chalybii* as the more derived since the scape gland is geniculate and the mid femoral fringe is more even (the primitive condition appears to be distal fringe much longer than proximal fringe).

The situation however, may not be this simple. Two species, *M. chalybii* and sp. nov. Argentina, do not entirely fit the species groupings on morphological data. The courtship patterns of these two species are not known, but correlating morphology with known courtship patterns allows some interpretive discussion.

Males of *M. chalybii* have setae on the ventral fore trochanters not unlike those of the *hawaiiensis* group although not as dense, short or stiff and the male scape gland is geniculate although not as well developed as in the *assemi* and *hawaiiensis* groups. However, in scape shape and proportions of the funicular segments (even to the extra, expanded ring segment) *M. chalybii* is extremely similar to *M. femorata* which morphologically is very definitely an *acasta* group species. The long setae on the male mid femora in *M. chalybii* are also of the *acasta* group pattern. If we look at the females of *M. chalybii* we find that they have the *acasta* group narrowly spaced facial grooves, but the eyes are densely setose as in the *hawaiiensis* and *assemi* groups. Thus we find a mixture of morphological features in *M. chalybii* which can be found in all three groups. Sp. nov. Argentina males are easily placed in the *assemi* group on all features except for relatively broad wings. The females differ in that their facial grooves are narrowly spaced as in the *acasta* group.

Turning now to courtship, we find that in *M. australica* (*hawaiiensis* group) the male courtship position involves close application of his mouthparts onto the relatively broad area between the facial grooves of the female, in fact I observed that this area of the female is pushed inwards by the male's mandibles. I have not observed courtship of the *assemi* group species but in *M. assemi* and *M. sosui* the male position as reported by van den Assem and Maeta (1980) and van den Assem et alia (1982) resembles that of the *hawaiiensis* group. From their discussions it is not clear whether the male's mandibles impinge on the area between the facial arms of the female in these two species, but since the area between the facial arms in females of these species is broad there may be some correlation between breadth of this area and male position. If this is so then the courtship position of sp. nov. Argentina it not as in the *hawaiiensis* group but may be more like the *acasta* group where this area in females is relatively narrow. Another factor in both sp. nov. Argentina and *M. bekiliensis* (both *assemi* group) is the relatively broad male wings more like *acasta* group males than males of the *hawaiiensis* group or *M. assemi* and *M. sosui*. Broad male wings and wing vibration by males during courtship are a

correlation in the *acasta* group as are narrow male wings and no wing vibration during courship by *hawaiiensis* group species as well as the species *M. assemi* and *M. sosui*. Perhaps male wing vibration also occurs during courtship in sp. nov. Argentina and *M. bekiliensis*.

Species where the male scape gland is geniculate involve permanent antennal contact during courtship (*hawaiiensis* group, *M. assemi, M. sosui*) which contrasts with permanent contact either through only part of the courtship (*M. acasta, M. evansi*) or not at all (*M. digitata*). In *M. chalybii* the geniculate nature of the male scape gland may indicate that permanent antennal contact is more important during courtship in this species than in other *acasta* group species. The presence of the setal tuft on the male ventral fore trochanters in *M. chalybii* indicates that there may be some similarities between male courtship position in *M. chalybii* and the *hawaiiensis* group where these setae rest on the female's mesosoma. However, it may not be entirely so as *M. chalybii* females have narrowly separated facial grooves. The presence of densely setose eyes in females of the *hawaiiensis* and *assemi* groups correlates with a predominance of mid leg action during courtship. *M. chalybii* females have densely setose eyes which perhaps indicates that mid leg action during courtship in this species assumes a more important role than it does in the coursthip of other *acasta* group species.

From this speculative evidence there is some suggestion of convergent evolution in courtship behaviour and associated morphology in *Melittobia*. We may therefore be dealing with a polyphyletic group rather than a monophyletic one. Of key importance in understanding this are the coursthip patterns of *M. chalybii* and sp. nov. Argentina coupled with a more thorough knowledge of the world fauna. Africa and South America will no doubt yield many more species than are presently known.

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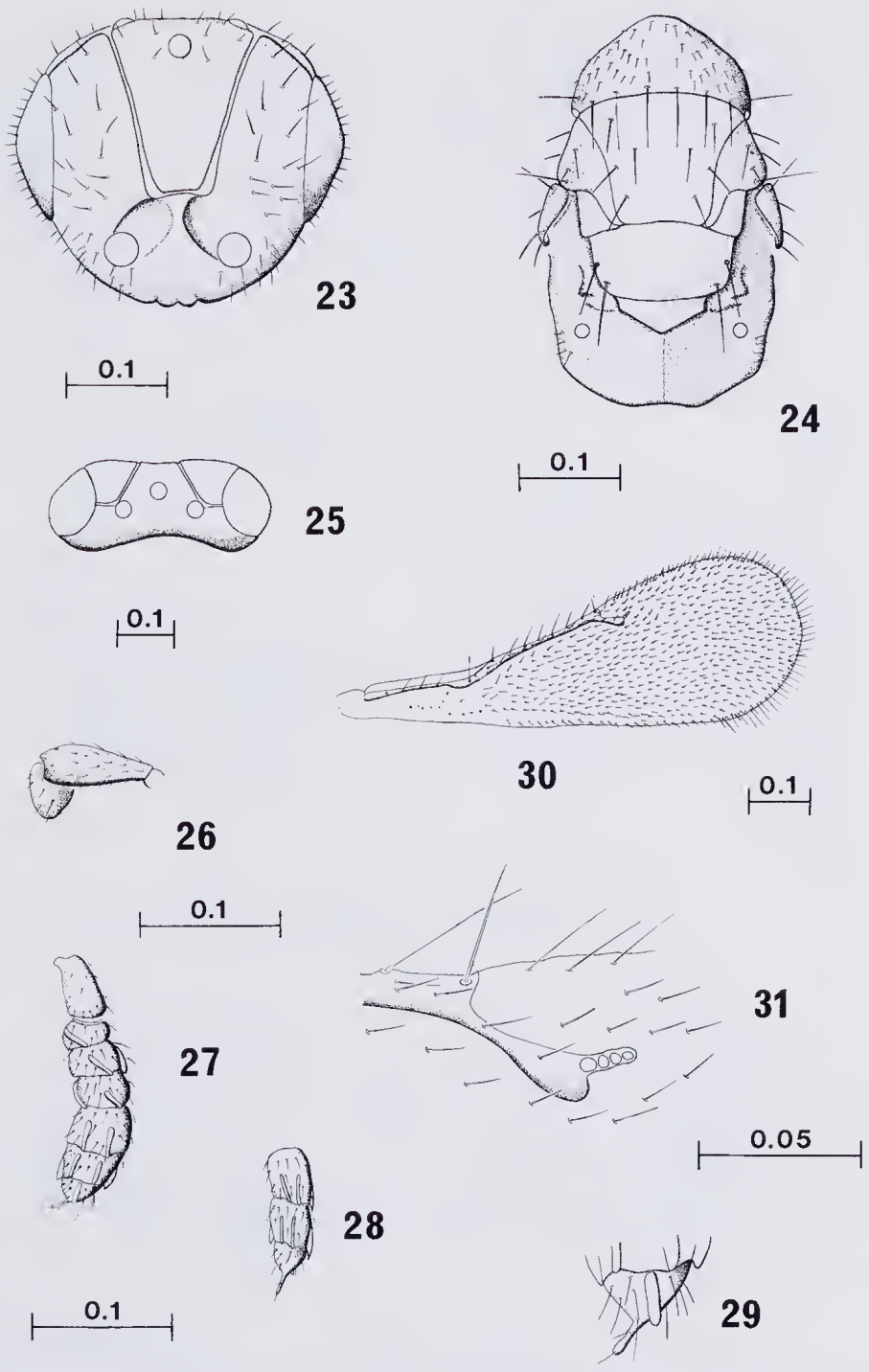
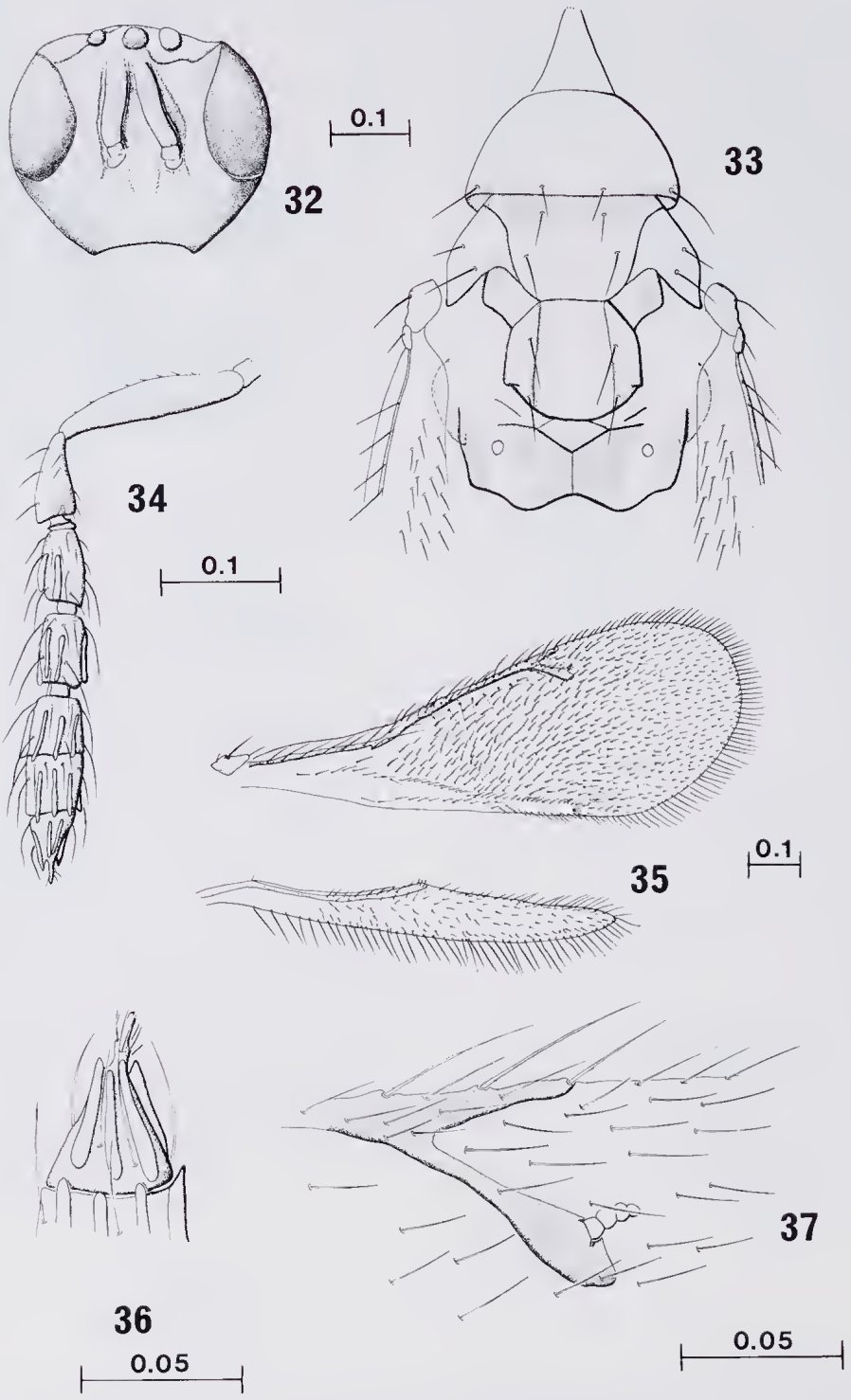
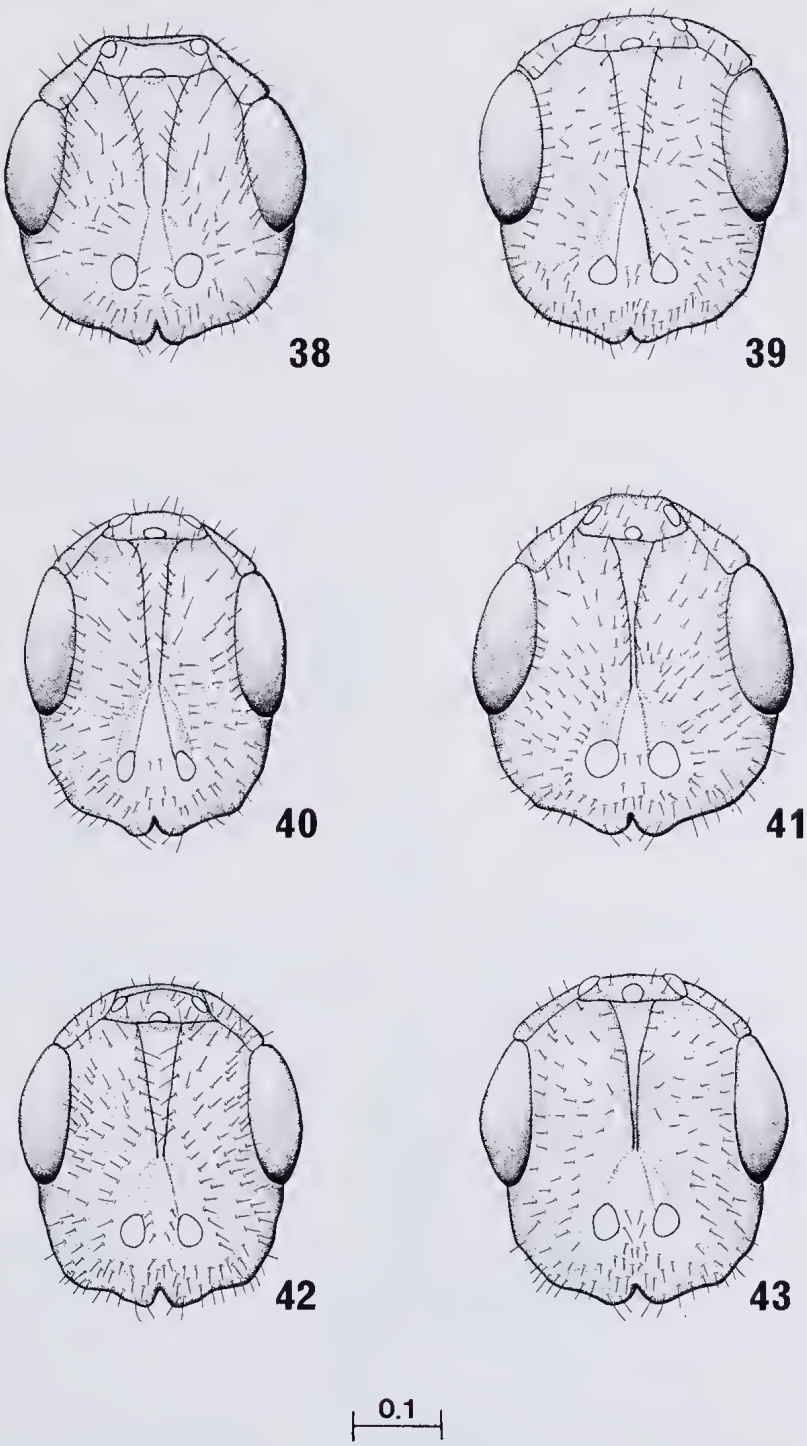


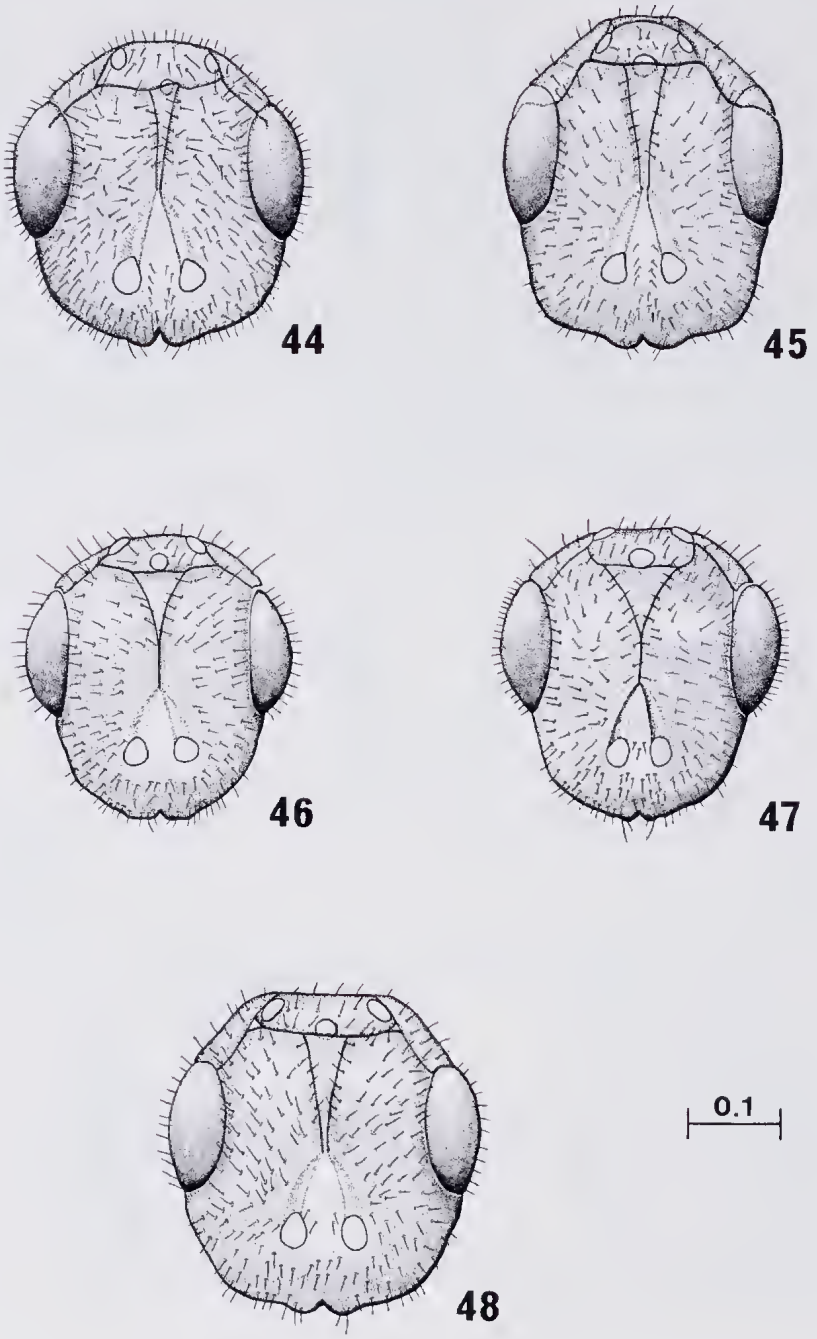
FIGURES 23, 24, 30-31, *Tachinobia diopsisephila* Female; 23 — Head, frontal aspect; 24 — Mesosoma, dorsal aspect; 26 — Scape and pedicel; 27 — Flagellum, dorsal aspect; 28 — Club, lateral aspect; 29 — Club segment 3; 30 — Fore wing; 31 — Stigmal vein. Fig. 25 — *Tachinobia repanda* female head, dorsal aspect.



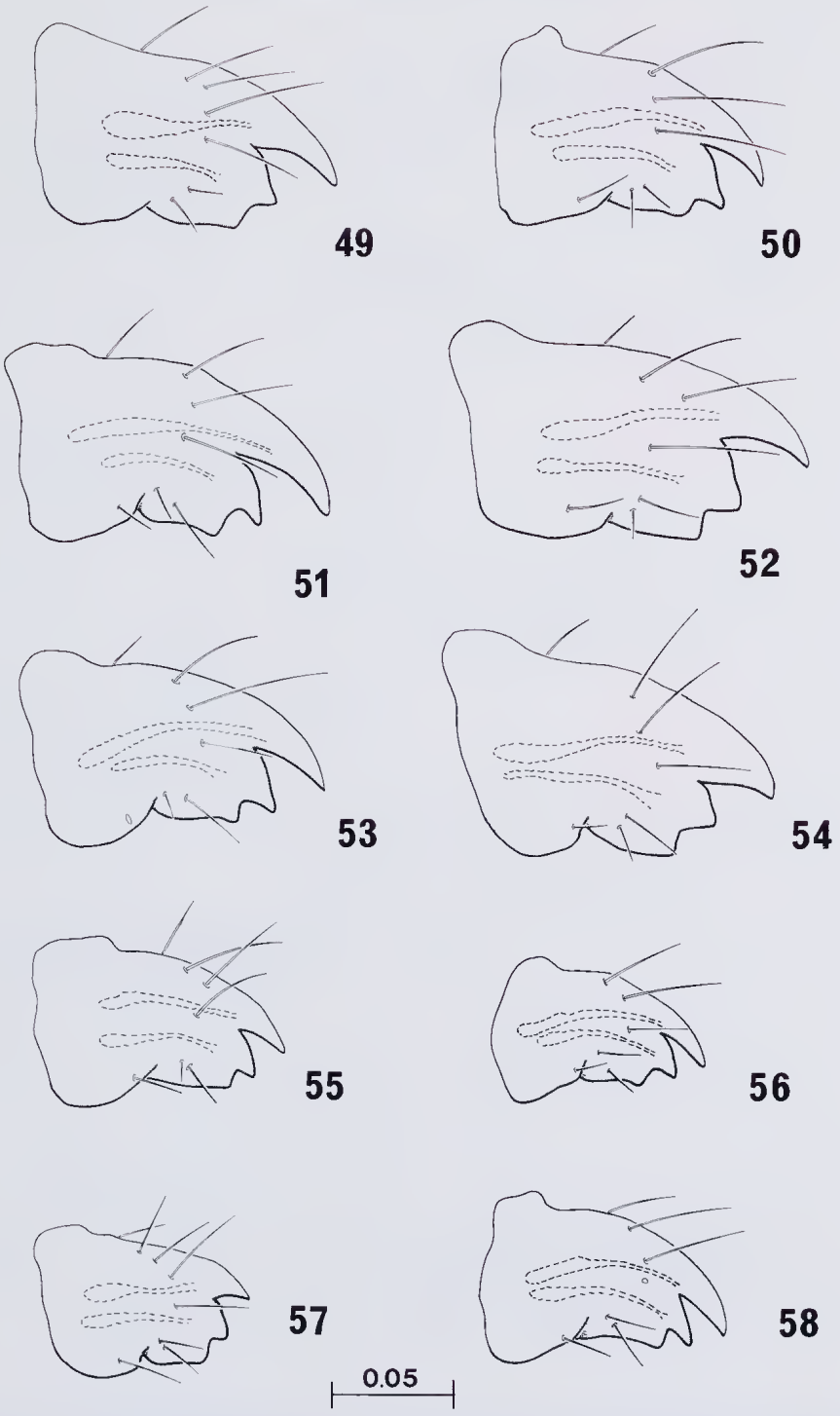
FIGURES 32-37, *Cirrospilus (Atoposomoidea) cosmopterygi* female; 32 — Head, frontal aspect; 33 — Mesosoma, dorsal aspect; 34 — antenna; 35 — wings; 36 — Club segment 3; 37 — Stigmal vein.



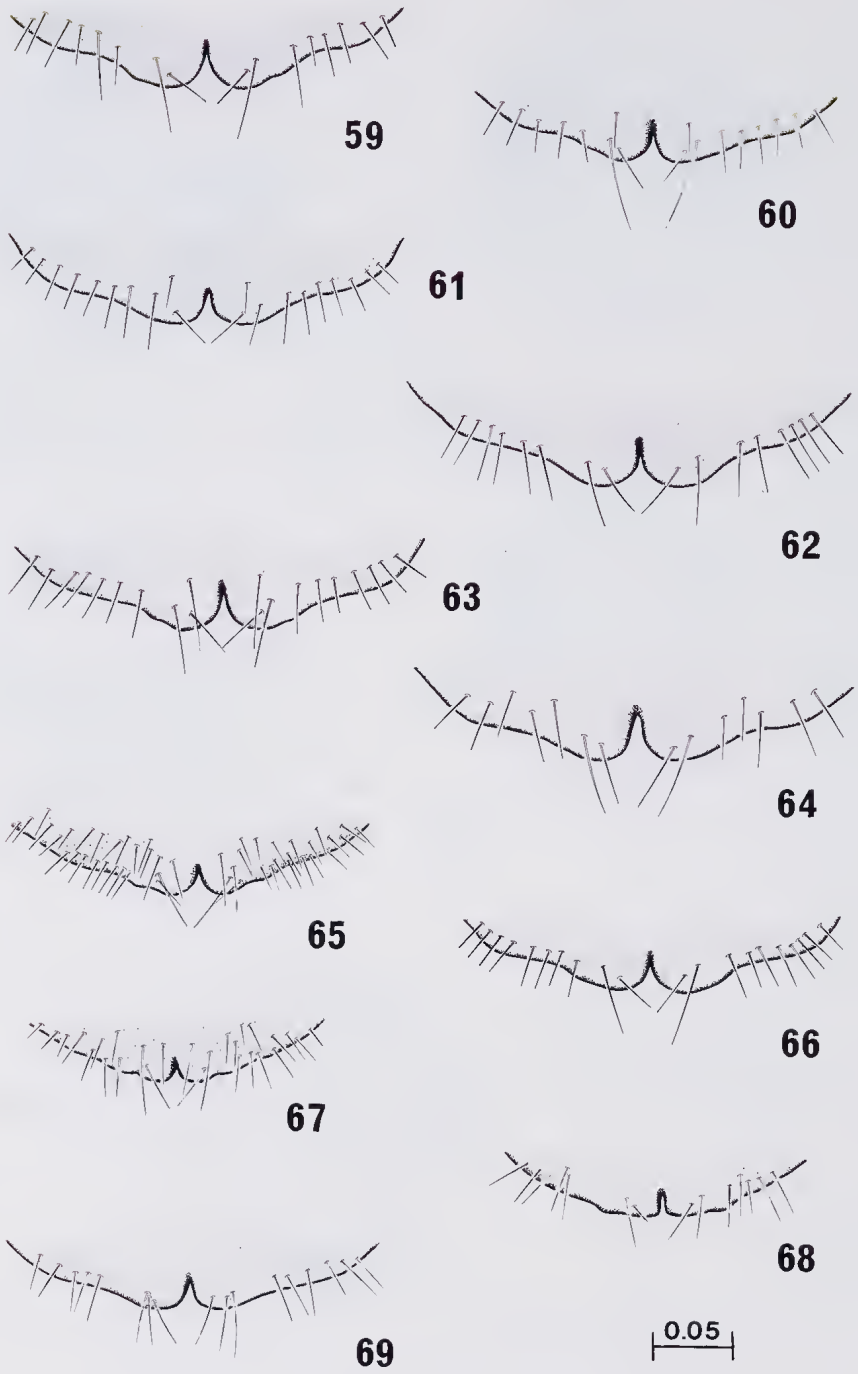
FIGURES 38–43, Female heads, *Melittobia* spp. 38 — *clavicornis;* 39 — *acasta;* 40 — *evansi;* 41 — *scapata;* 42 — *digitata;* 43 — *femorata.*



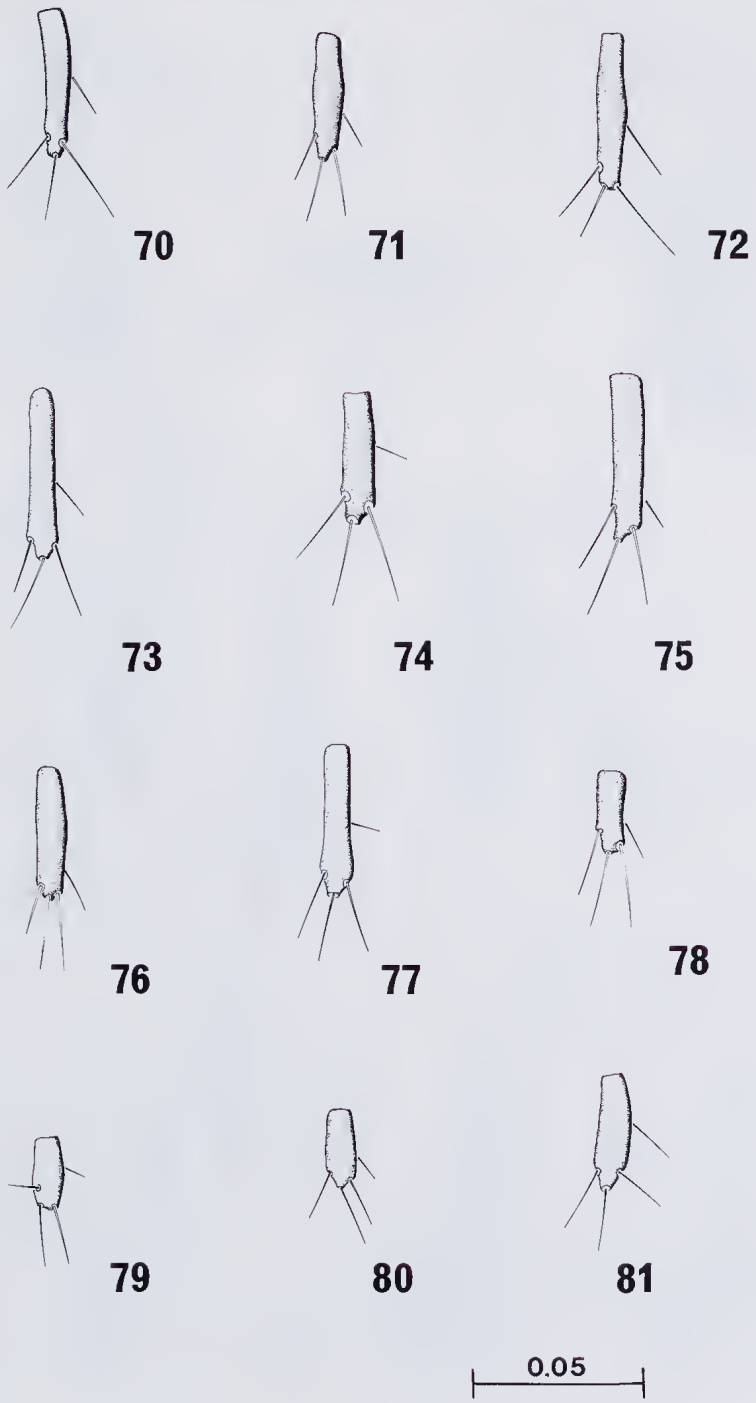
FIGURES 44–48, Female heads, *Melittobia* spp. 44 — *chalybii;* 45 — *megachilis;* 46 — *australica;* 47 — *sosui;* 48 — sp. nov. Argentina.



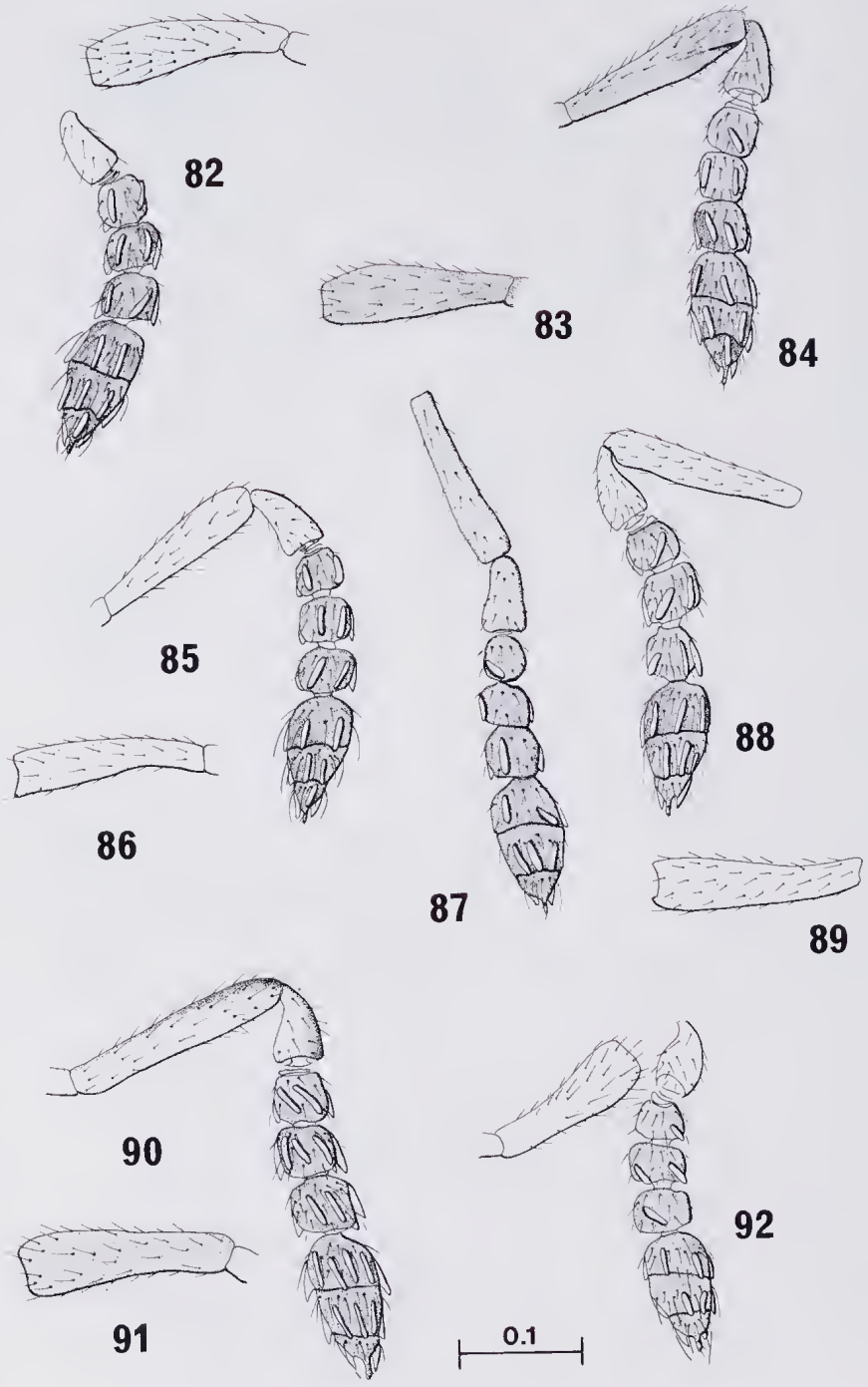
FIGURES 49–58, Female mandibles, *Melittobia* spp. 49 — *clavicornis;* 50 — *acasta;* 51 — *evansi;* 52 — *scapata;* 53 — *digitata;* 54 — *femorata;* 55 — *chalybii;* 56 — *australica;* 57 — *sosui;* 58 — sp. nov. Argentina.



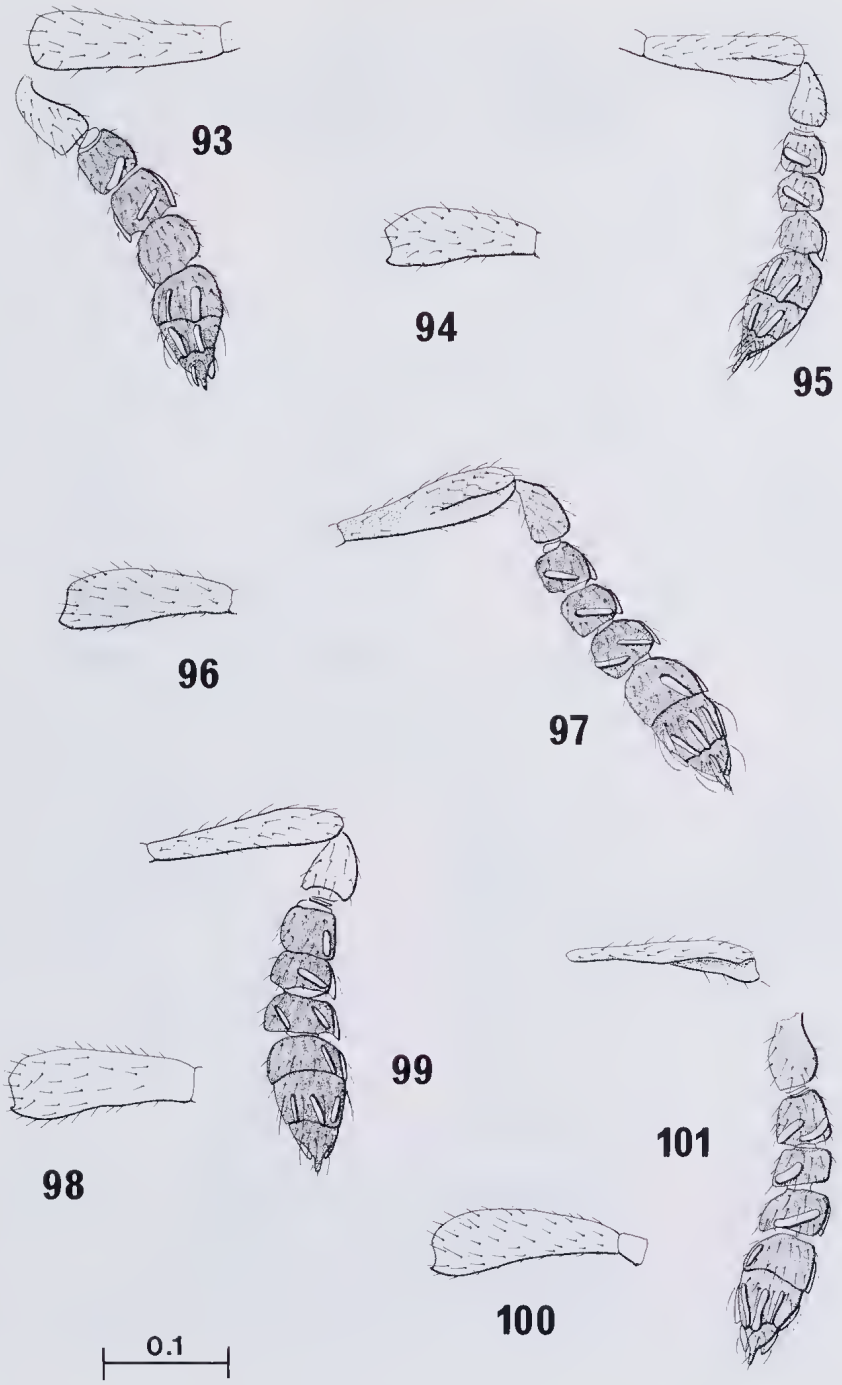
FIGURES 59–69, Female clypeal margins, *Melittobia* spp. 59 — *clavicornis;* 60 — *acasta;* 61 — *evansi;* 62 — *scapata;* 63 — *digitata;* 64 — *femorata;* 65 — *chalybii;* 66 — *megachilis;* 67 — *assemi;* 68 — *australica;* 69 — sp. nov. Argentina.



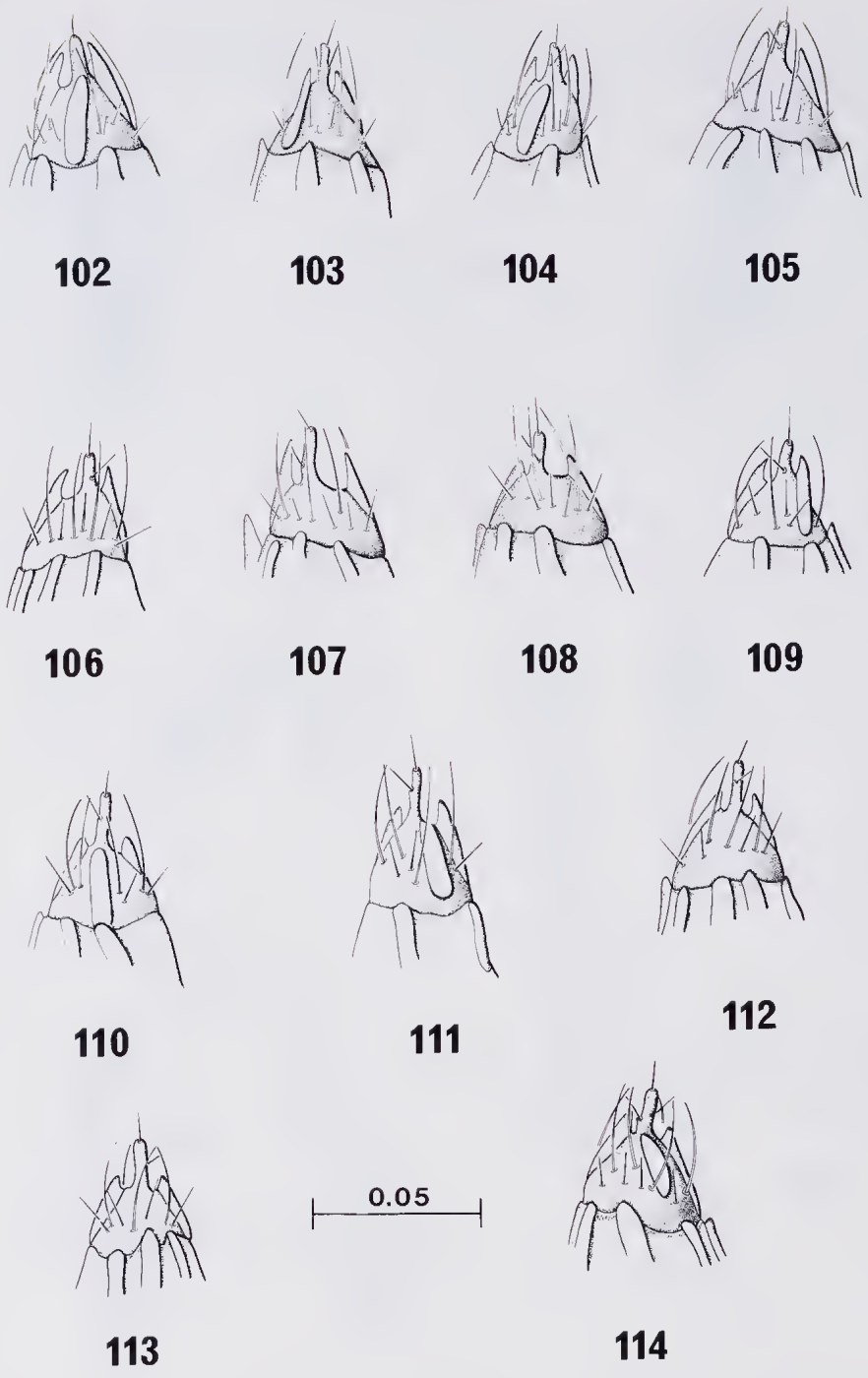
FIGURES 70–81, Female maxillary palps, *Melittobia* spp. 70 — *clavicornis;* 71 — *acasta;* 72 — *evansi;* 73 — *scapata;* 74 — *digitata;* 75 — *femorata;* 76 — *chalybii;* 77 — *megachilis;* 78 — *australica;* 79 — *assemi;* 80 — *sosui;* 81 — sp. nov. Argentina.



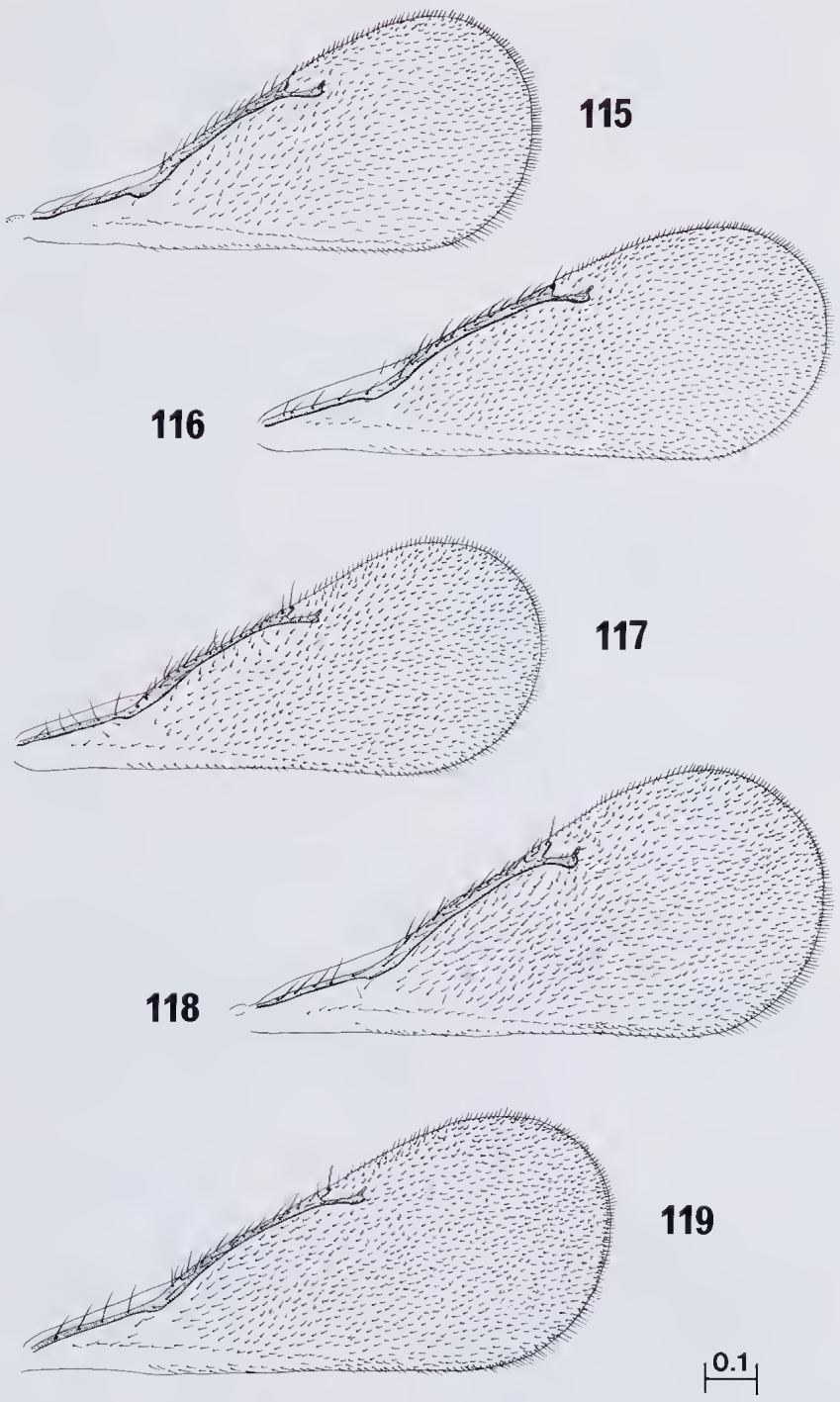
FIGURES 82–92, Female scapes and antennae, *Melittobia* spp. 82 — *clavicornis;* 83 — *acasta,* scape; 84 — *acasta;* 85 — *evansi;* 86 — *evansi* scape; 87 — *scapata;* 88 — *digitata;* 89 — *digitata,* scape; 90 — *femorata;* 91 — *femorata,* scape; 92 — *chalybii.*



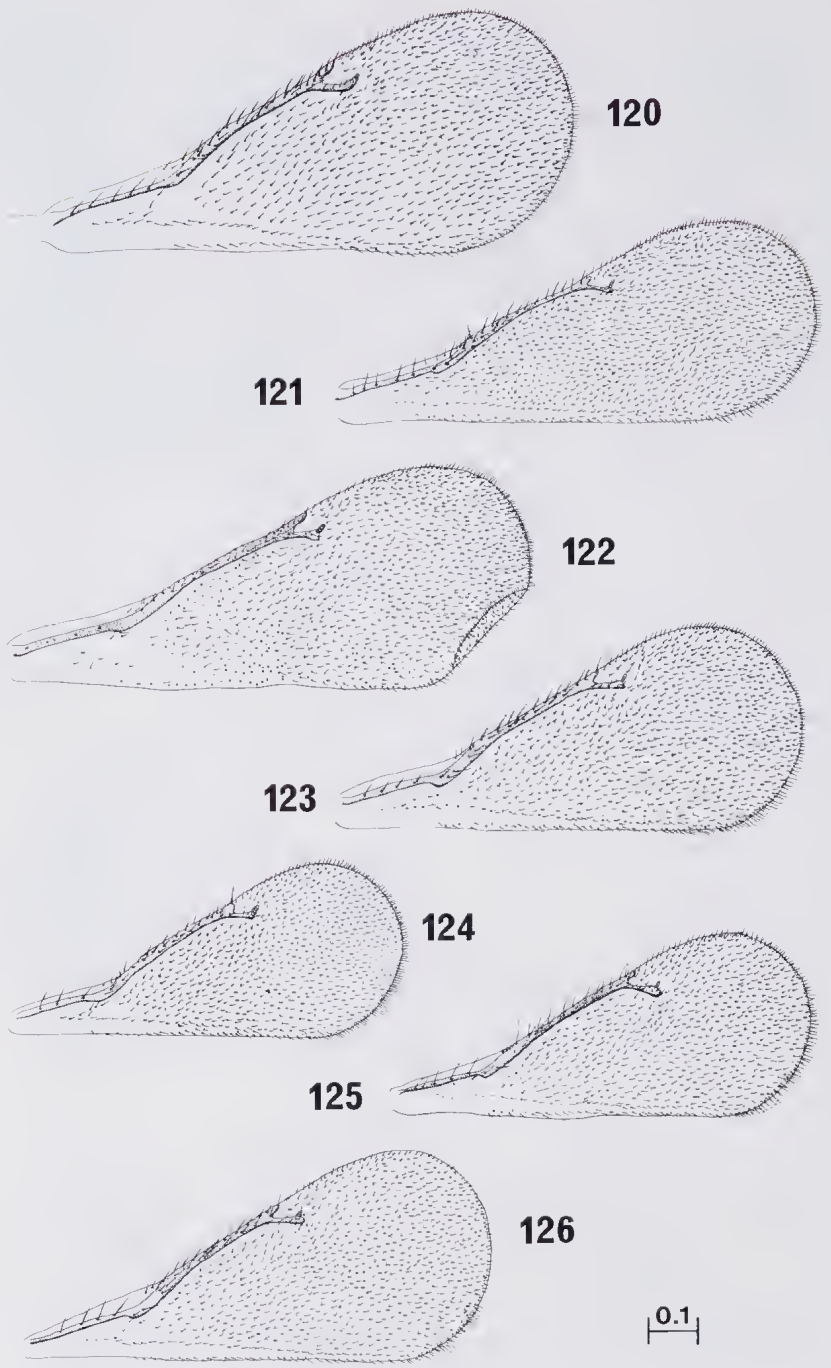
FIGURES 93–101, Female scapes and antennae, *Melittobia* spp. 93 — *megachilis;* 94 — Kauai, scape; 95 — Kauai; 96 — *australica,* scape; 97 — *australica;* 98 — sp. nov. Argentina, scape; 99 — sp. nov. Argentina; 100 — *sosui,* scape; 101 — *sosui.*



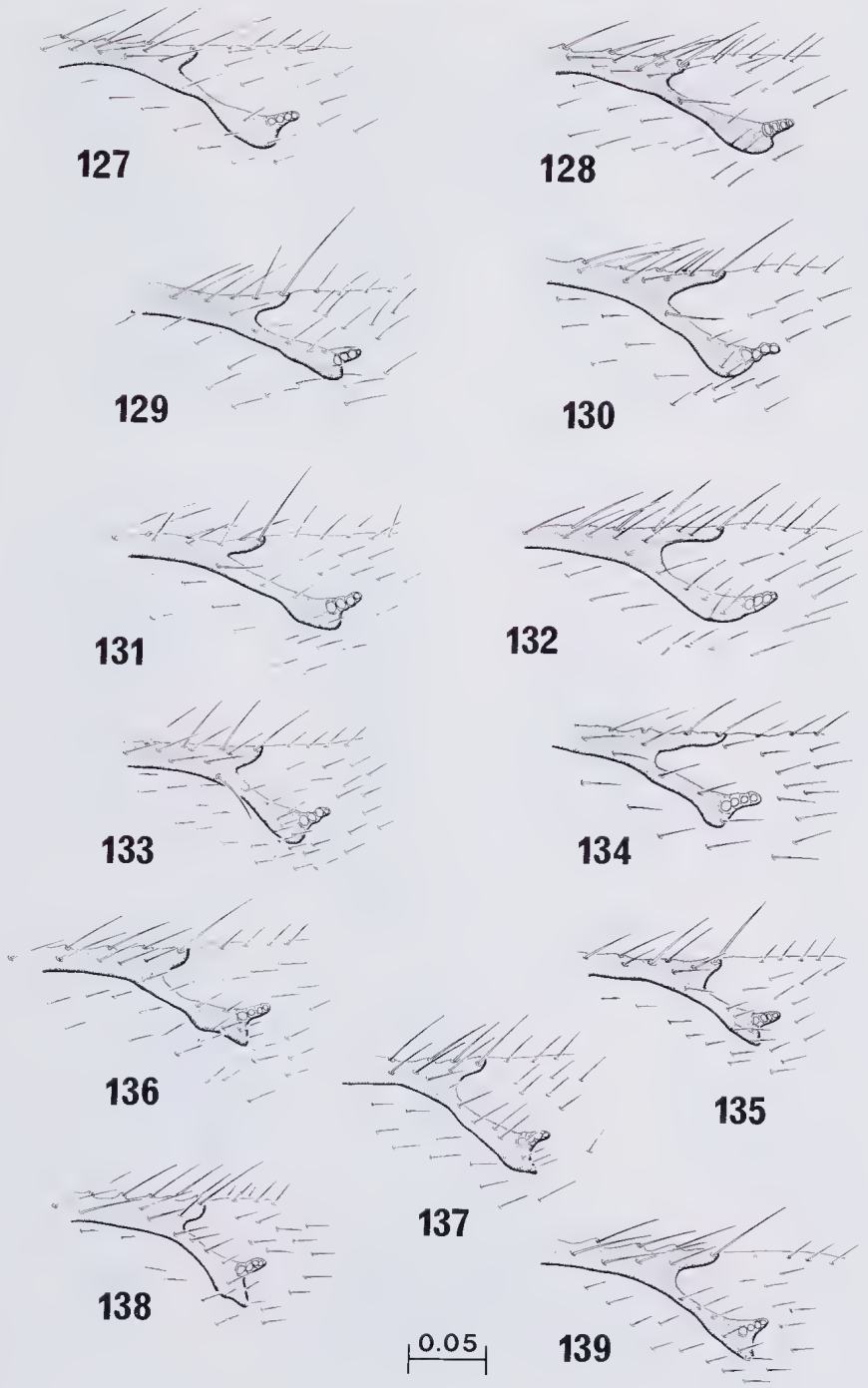
FIGURES 102–114, Female antennae, terminal segment, *Melittobia* spp. 102 — *clavicornis;* 103 — *acasta;* 104 — *evansi;* 105 — *scapata;* 106 — *digitata;* 107 — *femorata;* 108 — *chalybii;* 109 — *megachilis;* 110 — *hawaiiensis;* 111 — Kauai; 112 — *australica;* 113 — *sosui;* 114 — sp. nov. Argentina.



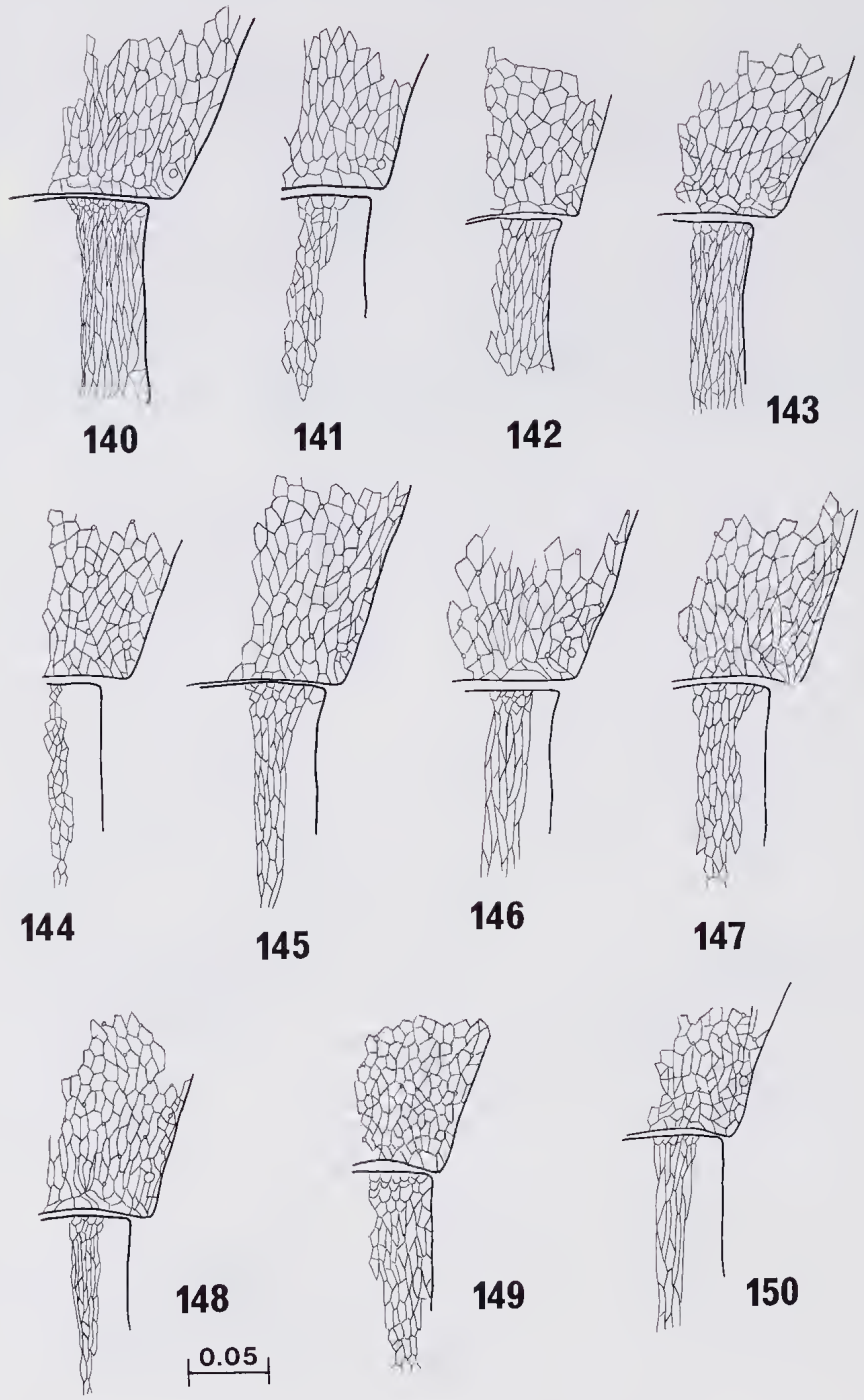
FIGURES 115–119, Female fore wings, *Melittobia* spp. 115 — *clavicornis;* 116 — *acasta;* 117 — *evansi;* 118 — *scapata;* 119 — *digitata.*



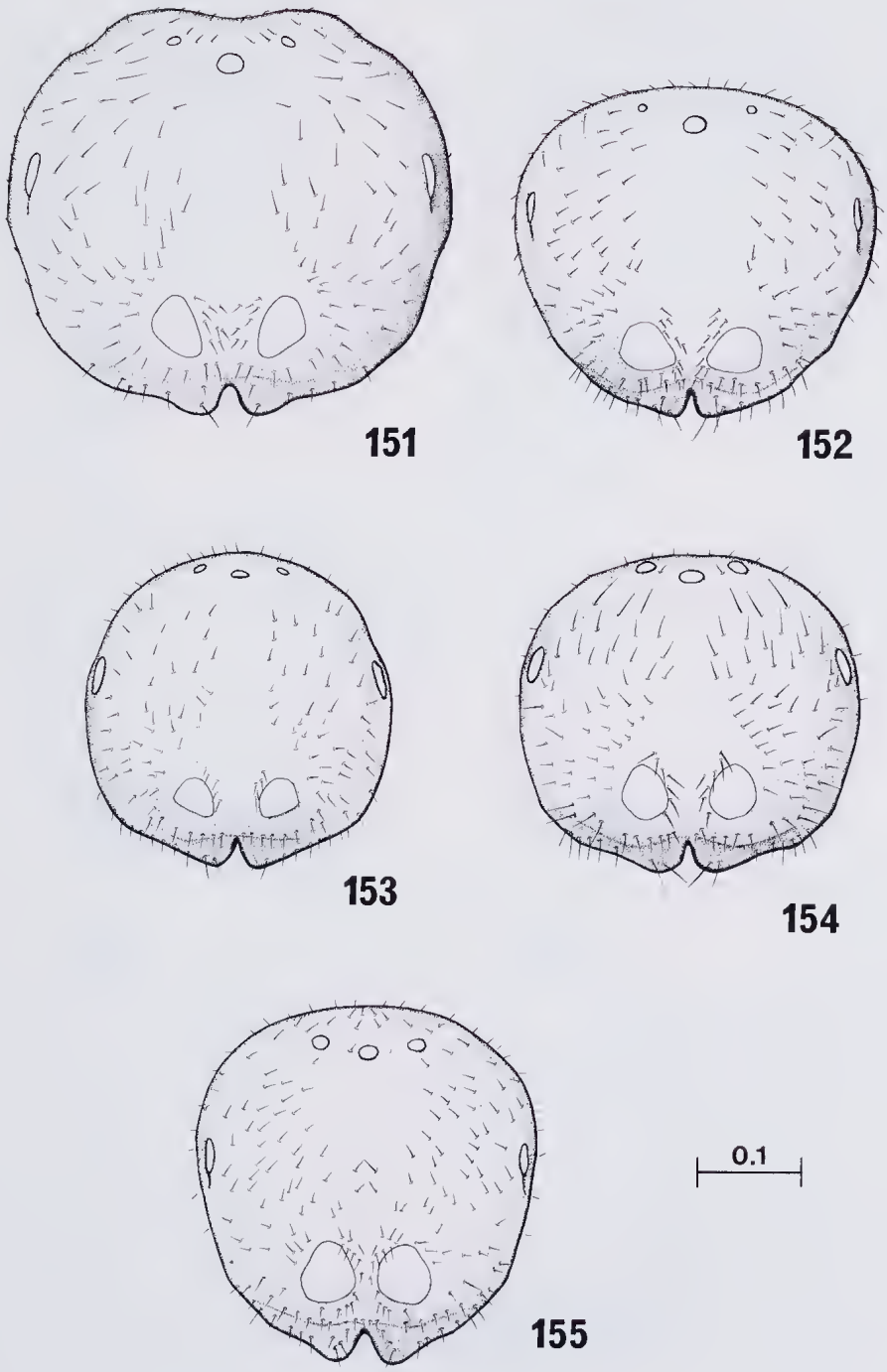
FIGURES 120–126, Female fore wings, *Melittobia* spp. 120 — *femorata;* 121 — *chalybii;* 122 — *megachilis;* 123 — *hawaiiensis;* 124 — *australica;* 125 — *assemi;* 126 — sp. nov. Argentina.



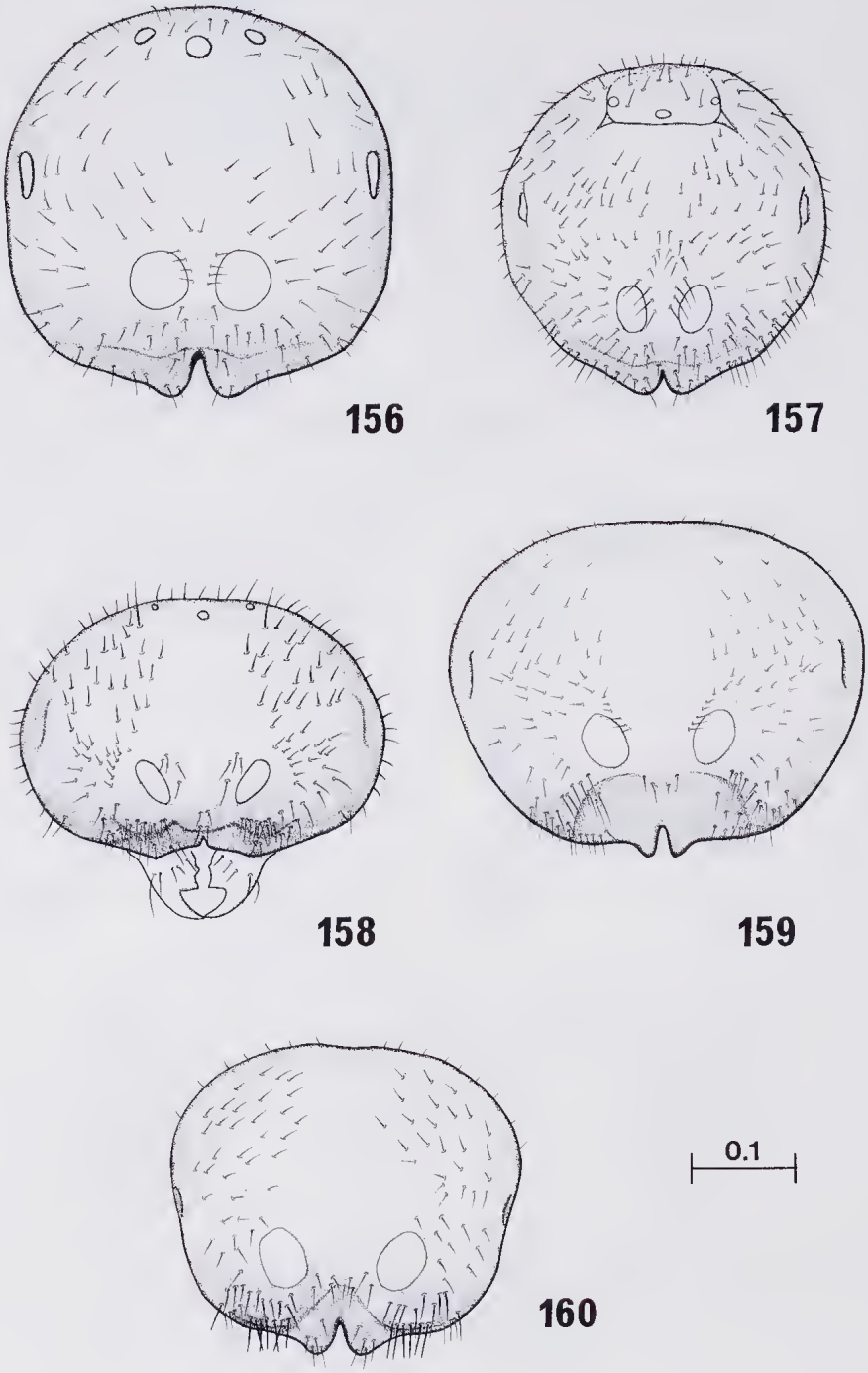
FIGURES 127–139, Female stigmal veins, *Melittobia* spp. 127 — *clavicornis;* 128 — *acasta;* 129 — *evansi;* 130 — *scapata;* 131 — *digitata;* 132 — *femorata;* 133 — *chalybii;* 134 — *megachilis;* 135 — *australica* (paralectotype); 136 — *hawaiiensis;* 137 — *assemi;* 138 — *sosui;* 139 — sp. nov. Argentina.



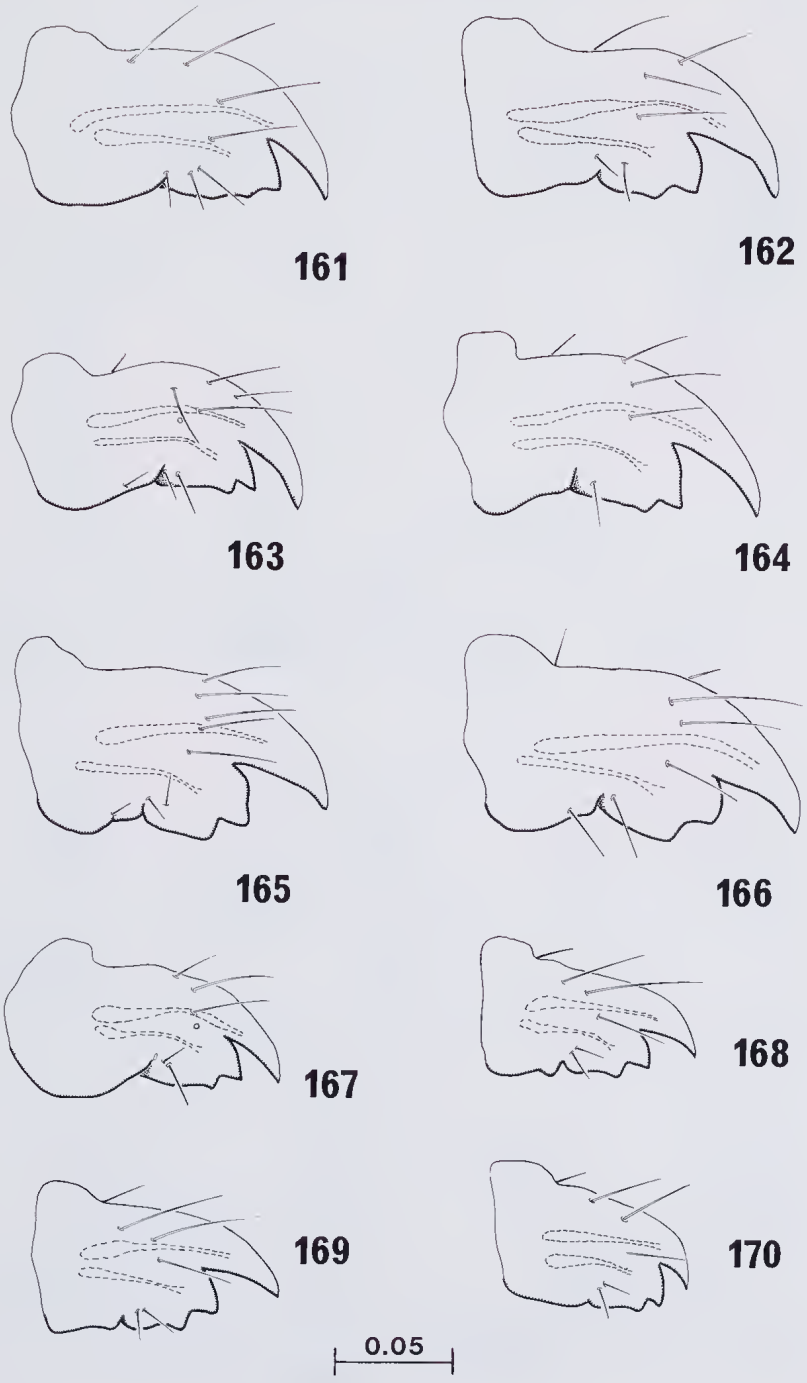
FIGURES 140-150, Female sculpture, mid lobe of mesoscutum, mid lobe of scutellum, *Melittobia* spp. 140 — *clavicornis;* 141 — *acasta;* 142 — *evansi;* 143 — *scapata;* 144 — *digitata;* 145 — *femorata;* 146 — *chalybii;* 147 — *megachilis;* 148 — *australica;* 149 — *assemi;* 150 — sp. nov. Argentina.



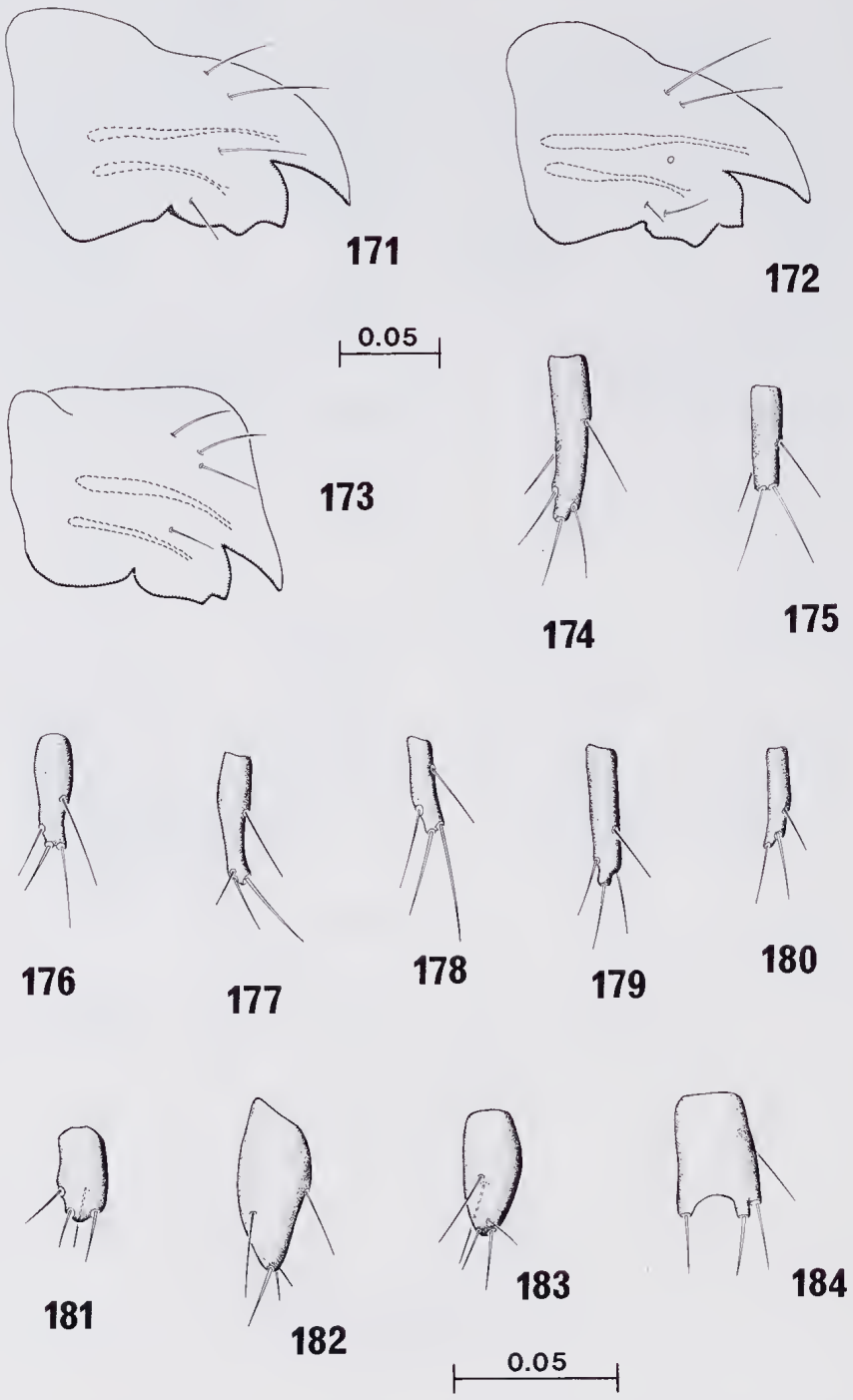
FIGURES 151–155, Male heads, *Melittobia* spp. 151 — *clavicornis;* 152 — *acasta;* 153 — *evansi;* 154 — *scapata;* 155 — *digitata.*



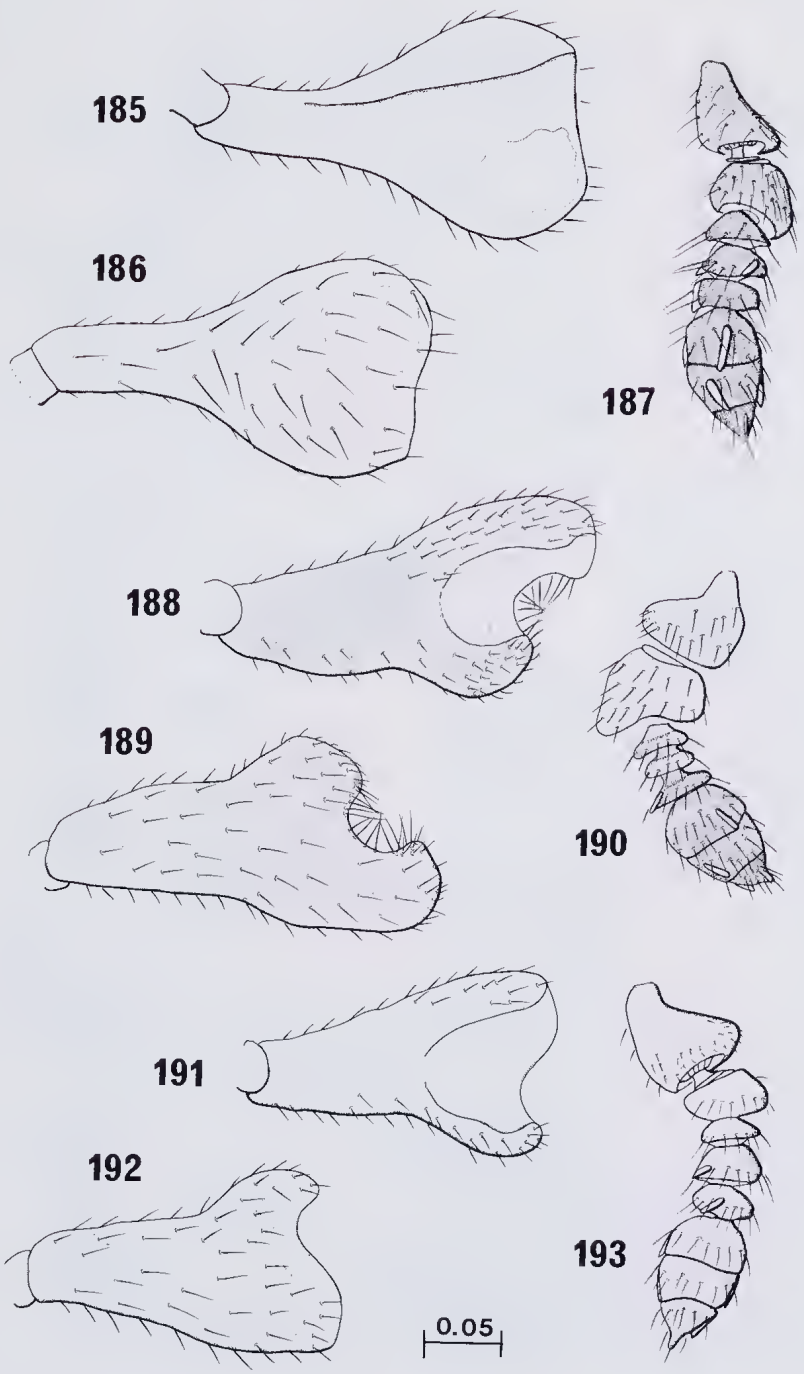
FIGURES 156–160, Male heads, *Melittobia* spp. 156 — *femorata;* 157 — *chalbyii;* 158 — *australica;* 159 — *assemi;* 160 — sp. nov. Argentina.



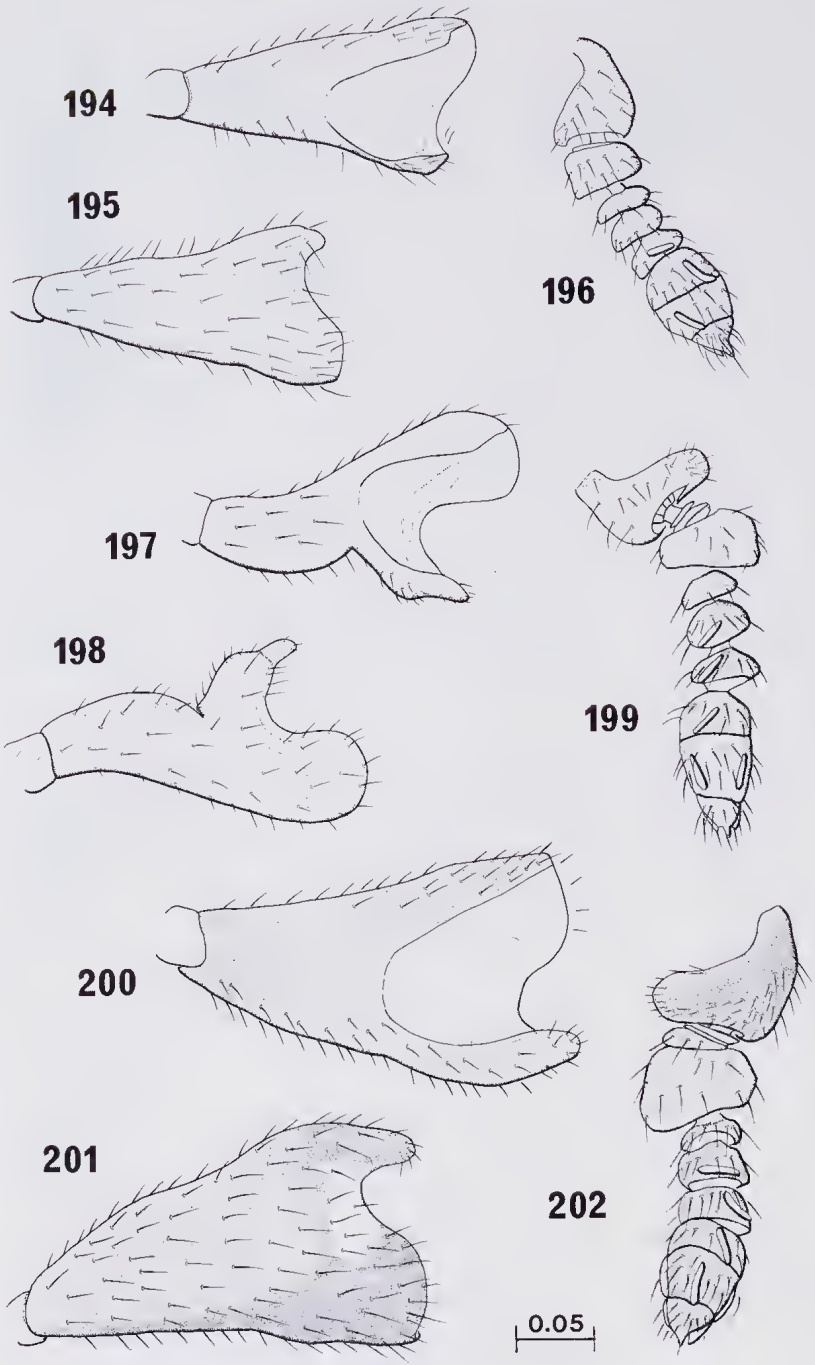
FIGURES 161–170, Male mandibles, *Melittobia* spp. 161 — *clavicornis;* 162 — *acasta;* 163 — *evansi;* 164 — *scapata;* 165 — *digitata;* 166 — *femorata;* 167 — *chalybii;* 168 — *hawaiiensis;* 169 — *australica;* 170 — Kauai.



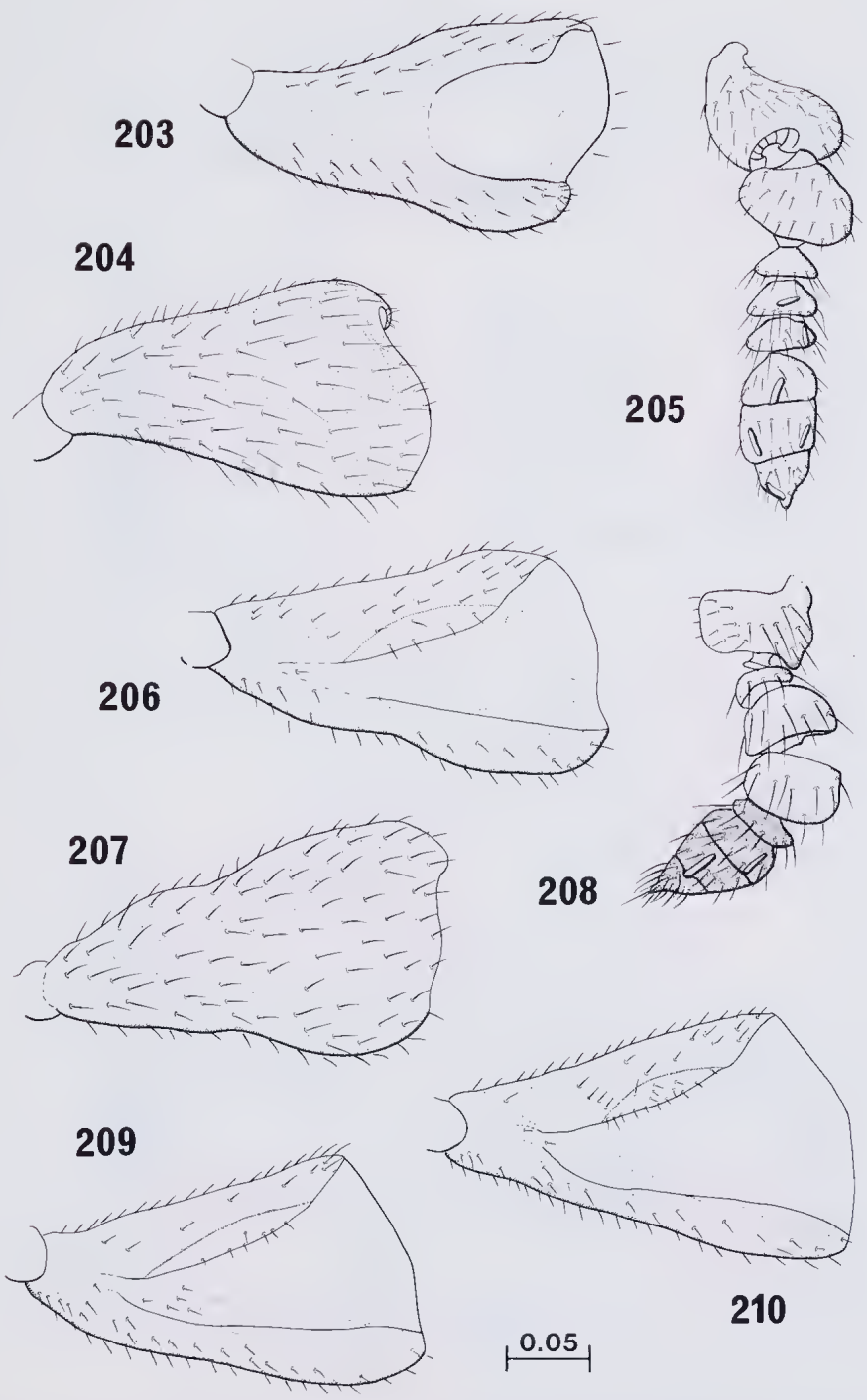
FIGURES 171–173, Male mandibles, *Melittobia* spp. 171 — *assemi;* 172 — *sosui;* 173 — sp. nov. Argentina.
FIGURES 174–184, Left male palps, *Melittobia* spp. 174 — *clavicornis;* 175 — *acasta;* 176 — *evansi;* 177 — *scapata;* 178 — *digitata;* 179 — *femorata;* 180 — *chalybii;* 181 — *australica;* 182 — *assemi* (reverse); 183 — *sosui;* 184 — sp. nov. Argentina.



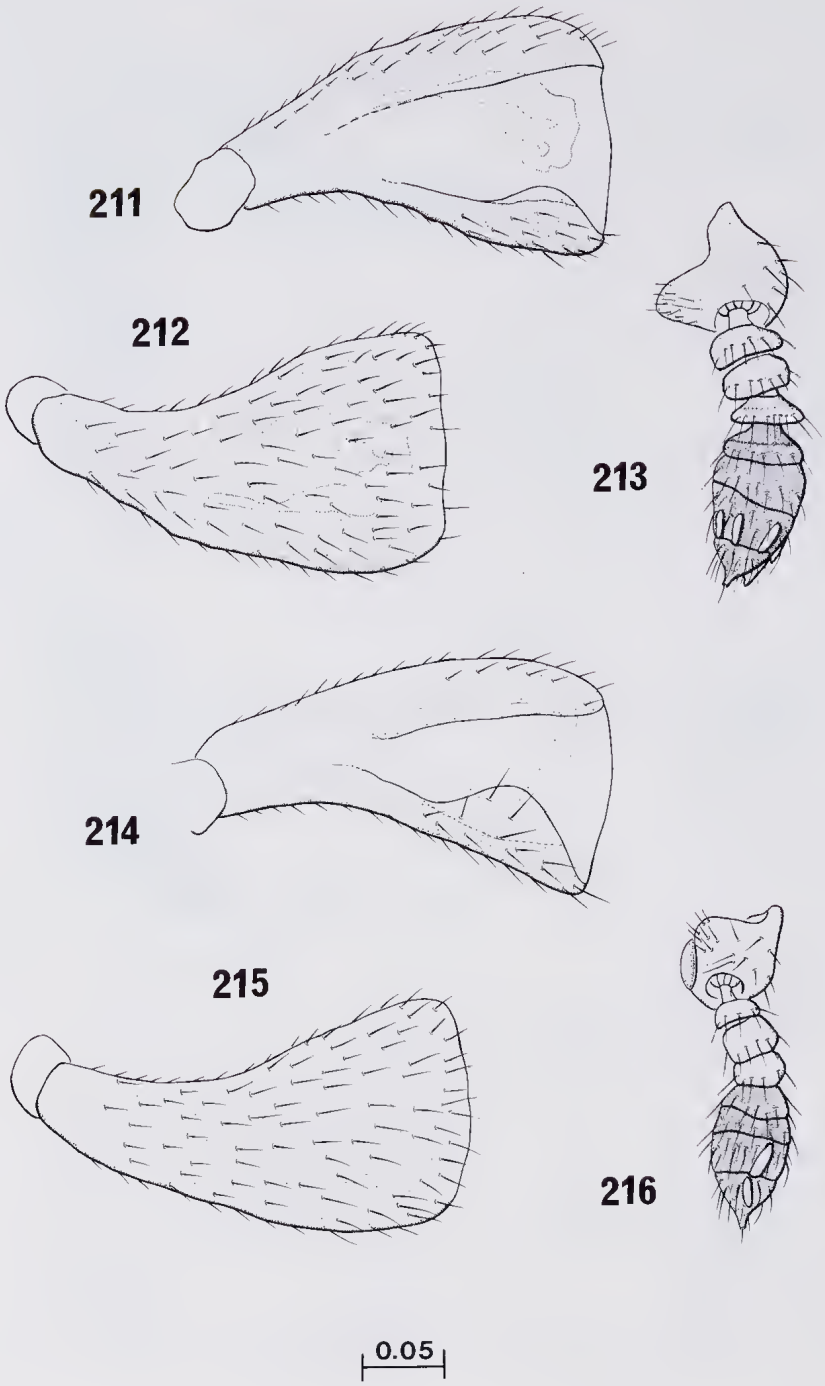
FIGURES 185–193, Male antennae, *Melittobia* spp. 185 — *clavicornis* ventral scape; 186 — *clavicornis* dorsal scape; 187 — *clavicornis* pedicel and flagellum; 188 — *acasta* ventral scape; 189 — *acasta* dorsal scape; 190 — *acasta* pedicel and flagellum; 191 — *evansi* ventral scape; 192 — *evansi* dorsal scape; 193 — *evansi* pedicel and flagellum.



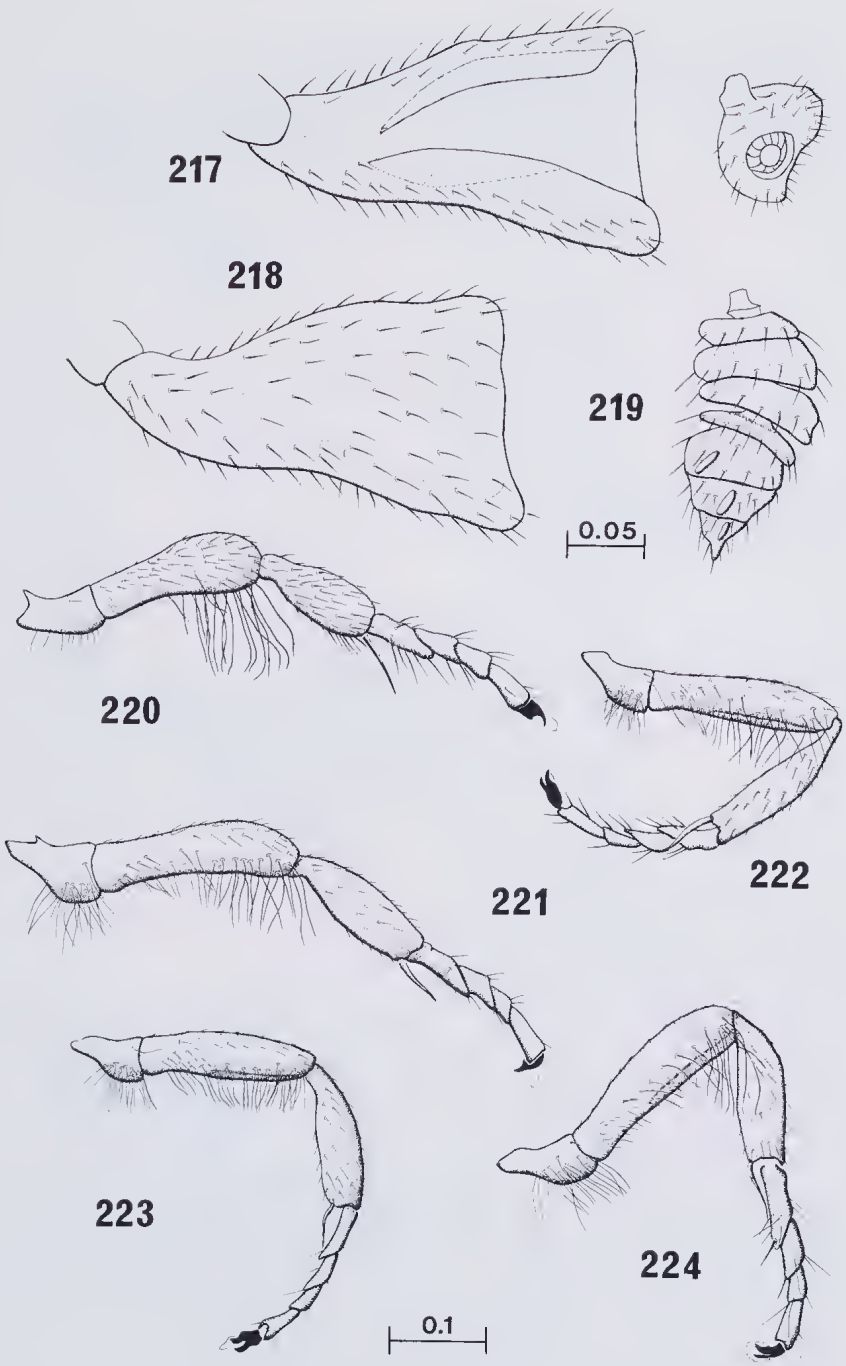
FIGURES 194-202, Male antennae, *Melittobia* spp. 194 — *scapata* ventral scape; 195 — *scapata* dorsal scape; 196 — *scapata* pedicel and flagellum; 197 — *digitata* ventral scape; 198 — *digitata* dorsal scape; 199 — *digitata* pedicel and flagellum; 200 — *femorata* ventral scape; 201 — *femorata* dorsal scape; 202 — *femorata* pedicel and flagellum.



FIGURES 203–210, Male antennae, *Melittobia* spp. 203 — *chalybii* ventral scape; 204 — *chalybii* dorsal scape; 205 — *chalybii* scape and flagellum; 206 — *australica* ventral scape; 207 — *australica* dorsal scape; 208 — *australica* pedicel and flagellum; 209 — *hawaiiensis* ventral scape; 210 — Kauai ventral scape.

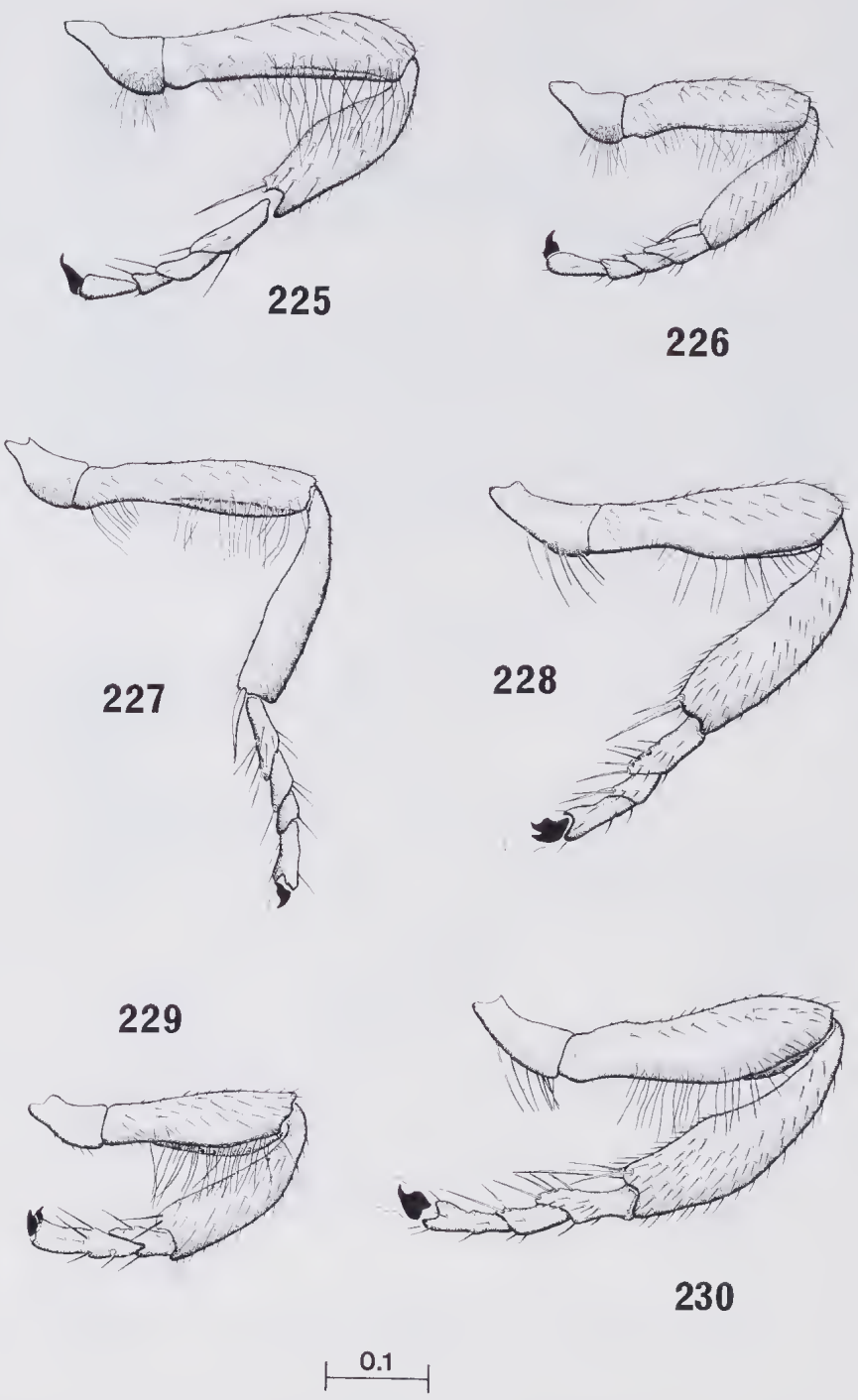


FIGURES 211–216, Male antennae, *Melittobia* spp. 211 — *assemi* ventral scape; 212 — *assemi* dorsal scape; 213 — *assemi* pedicel and flagellum; 214 — *sosui* ventral scape; 215 — *sosui* dorsal scape; 216 — *sosui* pedicel and flagellum.

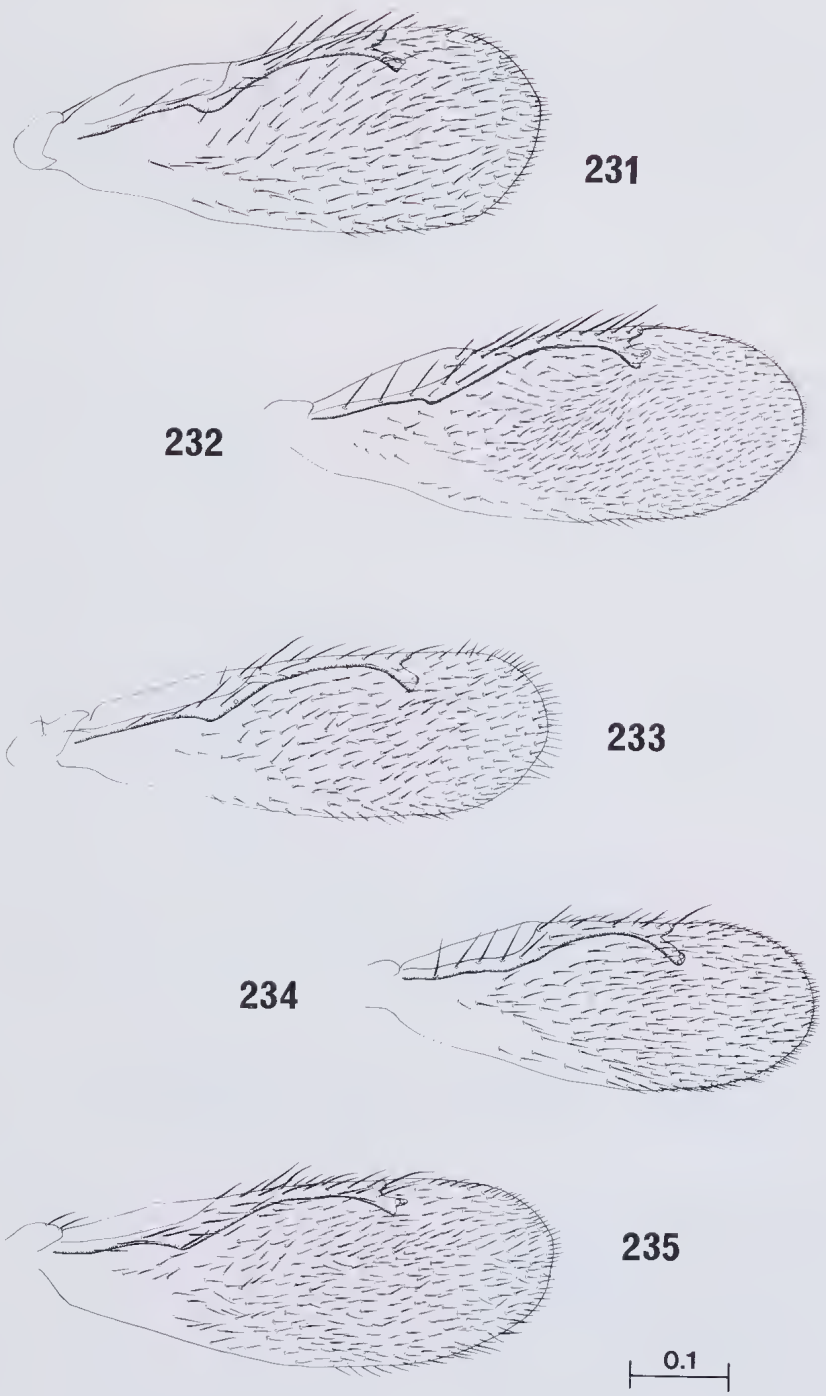


FIGURES 217–219, Male antennae, *Melittobia* spp. 217 — sp. nov. Argentina ventral scape; 218 — sp. nov. Argentina dorsal scape; 219 — sp. nov. Argentina pedicel and flagellum.

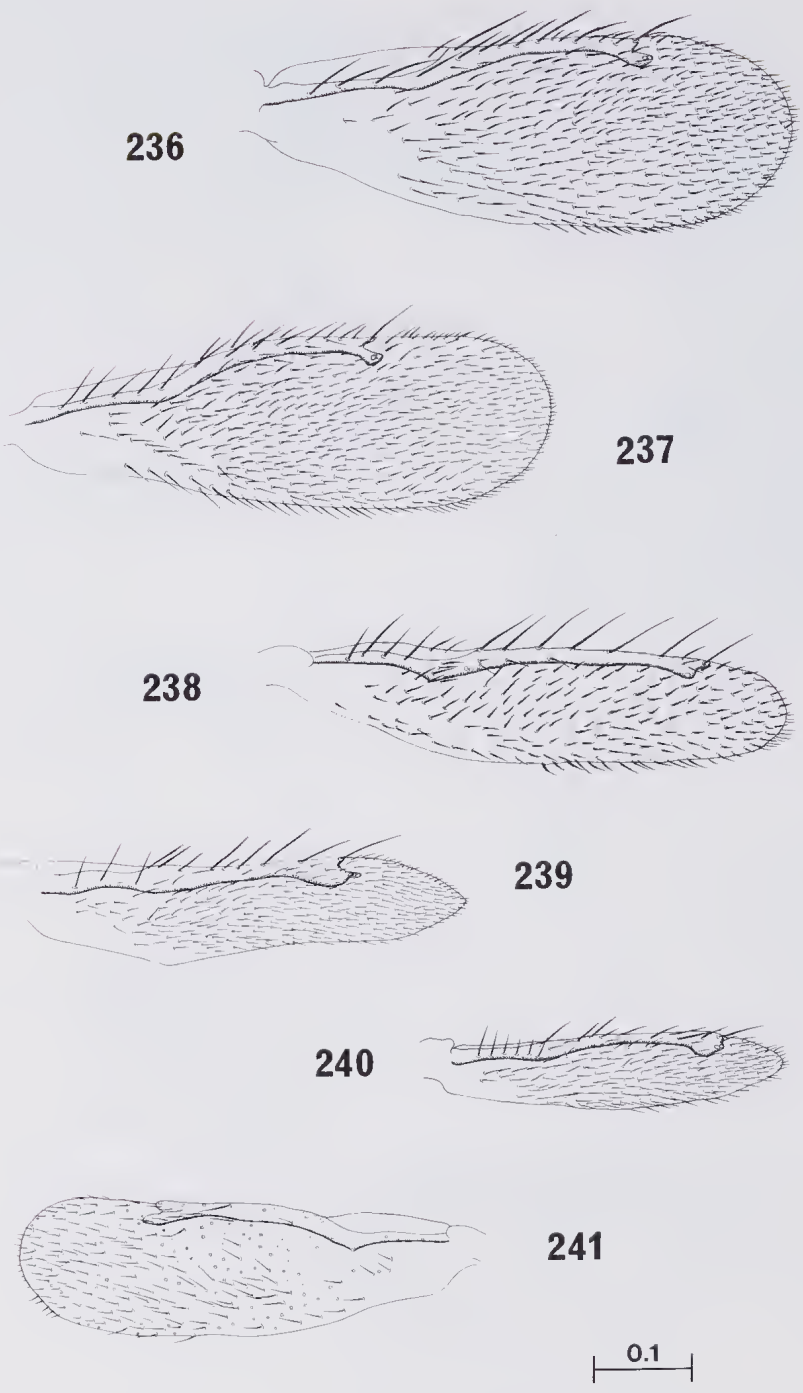
FIGURES 220–224, Male mid legs *Melittobia* spp. 220 — *clavicornis;* 221 — *acasta;* 222 — *scapata;* 223 — *evansi;* 224 — *digitata.*



FIGURES 225-230, Male mid legs, *Melittobia* spp. 225 — *femorata;* 226 — *chalybii;* 227 — *australica;* 228 — *assemi;* 229 — sp. nov. Argentina; 230 — *sosui.*



FIGURES 231–235, Male fore wings, *Melittobia* spp. 231 — *clavicornis;* 232 — *acasta;* 233 — *evansi;* 234 — *scapata;* 235 — *digitata.*



FIGURES 236-241, Male fore wings, *Melittobia* spp. 236 — *femorata;* 237 — *chalybii;* 238 — *australica;* 239 — *sosui* large form; 240 — *sosui* small form; 241 — sp. nov. Argentina.